2003 POLLUTION PREVENTION ROADMAP

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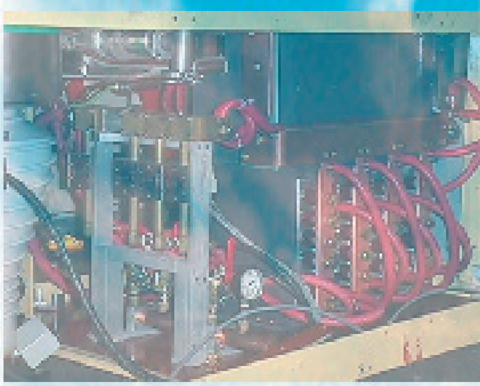

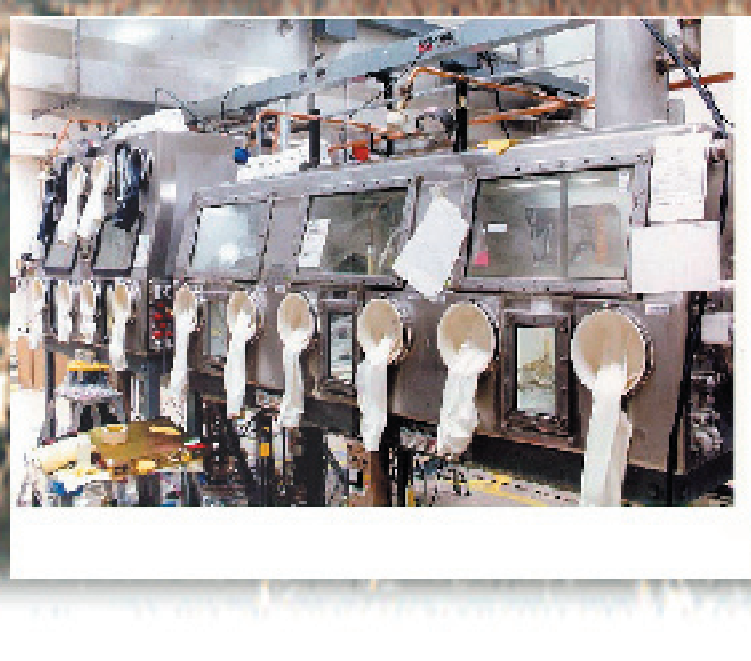

Los Alamos
NATIONAL LABORATORY

This 2003 roadmap is responsive to the pollution prevention and environmental efficiency goals issued by the Secretary of Energy on November 12, 1999; it is also certified to satisfy the waste minimization program documentation requirements of 40 CFR 264.73(b)(9) (Resource Conservation and Recovery Act). The roadmap is also responsive to 58 F.R. 102 (Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program and to Module VIII, Section B.1 of the Laboratory's Hazardous Waste Facility Permit.

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Foreword

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Executive Summary

Los Alamos National Laboratory (the Laboratory) has important national missions in national security, fundamental science and energy. Identifying, mitigating and eliminating the environmental impacts of these missions is the goal of the Pollution Prevention (PP) Office in the Risk Reduction and Environmental Stewardship (RRES) Division. The PP Office assists the Laboratory in eliminating these sources and reducing risk through proactive pollution prevention, waste minimization, recycling and resource conservation. Pollution prevention practices move the Laboratory beyond compliance-based goals toward zero waste produced, zero pollutants released, zero natural resources wasted, and zero natural resources damaged. Zero pollution means zero environmental risk to mission continuity.

This roadmap documents the Laboratory's Pollution Prevention Program and the processes used to define and implement environmental improvements. It describes current operations; improvements that will eliminate potential sources of environmental incidents, and the end state that is the Laboratory's goal. Over the next 24 months, the Laboratory will move to an Environmental Management System that embodies the concepts of ISO 14001. The Laboratory currently has implemented environmental protection as part of Integrated Safety Management (ISM) implementation. The focus of the EMS is on pollution prevention practices that will allow the Laboratory to move beyond a compliance-based approach to environmental management.

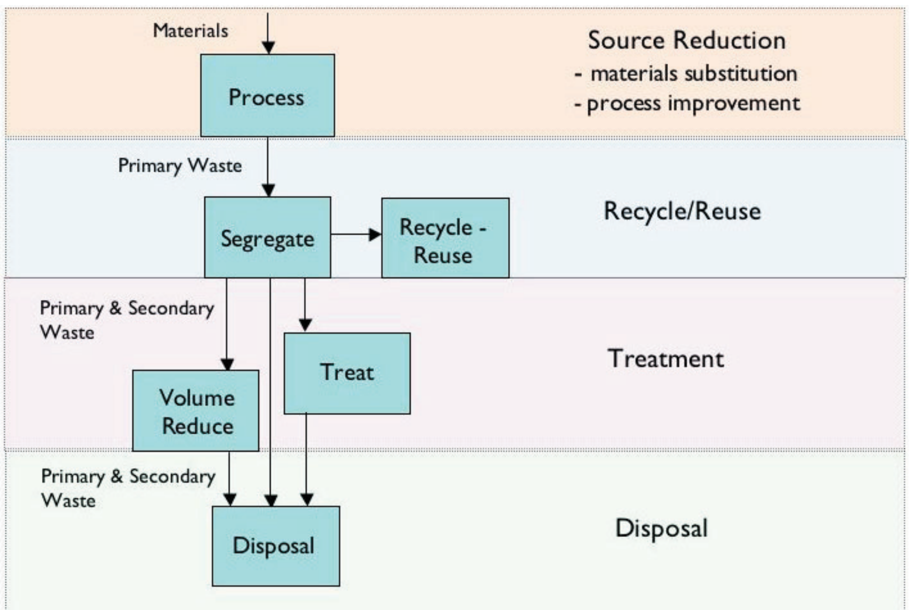
Systematic pollution prevention and environmental stewardship not only protect the environment; they also pay for themselves by reducing costs and creating a safer workplace. Furthermore, they increase productivity by minimizing both waste- and pollution-related planning, reporting and work tasks, enabling staff to devote more time to mission activities.. Through a pollution prevention focused EMS, environmental awareness, good environmental practices, and reducing the sources of environmental incidents become the responsibility of every person working at the site.

This 2003 roadmap is responsive to the pollution prevention and environmental efficiency goals issued by the Secretary of Energy on November 12, 1999; it is also certified to satisfy the waste minimization program documentation requirements of 40 CFR 264.73(b)(9) (Resource Conservation and Recovery Act). The roadmap is also responsive to 58 F.R. 102 (Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program and to Module VIII, Section B.1 of the Laboratory's Hazardous Waste Facility Permit.

Chapter 1: Pollution Prevention - What and Why

Background

The Pollution Prevention Program improves Laboratory operations with the goal of preventing environmental damage and adverse regulatory findings. The Laboratory's commitment to pollution prevention and broader environmental stewardship arises from two goals: the goal of maintaining a good environmental and ecological condition for present and future employees, residents and neighbors and the goal to remain in compliance with the various regulatory requirements attendant to operation of the Laboratory. In order to progress toward these goals the Laboratory's Waste Minimization/Pollution Prevention (WMin/PP) approach will focus on:



- integrating waste minimization principles into the planning process;
- supporting the development of new technologies to minimize waste;
- working with generators to identify waste minimization opportunities;
- utilizing material substitution and process improvements, as appropriate;
- recycling and reusing materials; and
- tracking, projecting, and analyzing waste data to improve waste management.

The accompanying figure shows the hierarchy for waste generation. Source reduction will clearly have the largest effect on the waste streams and is the preferred method of reducing waste. Although source reduction is preferred, the WMin/PP approach recognizes there may be limited opportunity for source reduction of primary wastes. When appropriate, source reduction of primary wastes will be accomplished through process modification or material substitution. Reduction of secondary wastes will be accomplished through proper planning; improved housekeeping, segregation, characterization; and application of WMin/PP criteria during project planning, design, and construction activities. Recycling and reuse practices will be considered for all primary and secondary wastes. Volume reduction (including size reduction, compaction, and optimal packaging) and waste treatment will be considered for all primary and secondary wastes for which generation cannot be avoided and which cannot be recycled. Wastes that remain after the previous steps have been completed will be disposed. Disposal is the least desirable, and often the most expensive, way of solving the waste generation problem.

The WMin/PP approaches outlined above are consistent with the waste reduction priorities established by the Laboratory's sitewide waste minimization plan, which recognizes the severe limitations of on-site disposal capacity for radioactive LLW and on-site storage capacity for LLMW. In addition, the approach was adopted to address the variable and nonrecurring nature of wastes coming from RRES-RS activities.

This roadmap outlines steps being taken at Los Alamos to focus on the life-cycle of waste generation, management and disposal through proactive pollution prevention programs. Such analysis starts when technical programs are envisioned, facilities planned and processes selected. It also describes projects to revisit current processes and their waste streams to provide environmentally preferable alternatives.

Regulatory Drivers

The Laboratory is subject to a variety of regulatory requirements regarding pollution prevention and waste minimization. A comprehensive list of these regulatory drivers has been prepared by Shaw Environmental, Inc. and is briefly summarized in the following table.

Driver/Document Title	***Requirement***
DOE Order 413.3 Program and Project Management for the Acquisition of Capital Assets	Sustainable building design principles must be applied to the siting, design, and construction of new facilities. New Federal buildings must meet or exceed energy efficiency standards established under the Energy Policy Act, Public Law 102-486, Section 305.
DOE Order 430.1A Life Cycle Asset Management	The management of physical assets from acquisition through operations and disposition shall be integrated and seamless process linking the various life cycle phases.
DOE Order 430.2A Departmental Energy and Utilities Management	Major facilities contractors managing and operating Department of Energy (DOE), including National Nuclear Security (NNSA), facilities or subcontracting the operation and maintenance of DOE facilities must have a documented energy management program and an energy management plan.
DOE Order 435.1 Radioactive Waste Management	In the performance of this contract, the contractor is required to: *assist DOE in meeting its obligations and responsibilit*ies under Executive Order 12856 (replaced by 13148), Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, and Executive Order 13101 and The Pollution Prevention Act of 1990.
DOE Order 450.1 Environmental Protection Program	Implement sound stewardship practices, by implementing Environmental Management Systems (EMSs) at DOE sites.
LANL Hazardous Waste Facility Permit	Requires that a waste minimization program be in place and that a certified plan be submitted annually to the administrative authority. The program must include elements as listed in Module VIII, Section B.1 of the permit.
Executive Order 13101 Greening the Government Through Waste Prevention, Recycling and Federal Acquisition	Consistent with the demands of efficiency and cost effectiveness, the head of each executive agency shall incorporate waste prevention and recycling in the agency's daily operations and work to increase and expand markets for recovered materials through greater Federal Government preference and demand for such products. services that serve the same purpose. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product or service.
Executive Order 13123 Greening the Government through Efficient Energy Management	Through life-cycle cost-effective energy measures, each agency shall reduce its greenhouse gas emissions and resource consumption attendant to energy usage.

Driver/Document Title	Requirement
Executive order 13148 Greening the Government Through Leadership in Environmental Management	Each agency shall comply with environmental regulations by establishing and implementing environmental compliance audit programs and policies that emphasize pollution prevention as a means to both achieve and maintain environmental compliance.
Executive order 13149 Greening the Government Through Federal Fleet and Transportation Efficiency	The purpose of this order is to ensure that the Federal Government exercises leadership in the reduction of petroleum consumption through improvements in fleet fuel efficiency and the use of alternative fuel vehicles (AFVs) and alternative fuels.
Executive Order 13221 Energy Efficiency Standby Power Devices	Each agency, when it purchases commercially available, off-the-shelf products that use external standby power devices, or that contain an internal standby power function, shall purchase products that use no more than one watt in their standby power consuming mode.
Pollution Prevention Act of 1990 (42USC13101)	National policy requires that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.
Resource Conservation & Recovery Act (RCRA) Affirmative Procurement (42 USC 6962)	This regulation was further codified in 40 CFR 247 - Comprehensive Guidelines for the Procurement of Products Containing Recovered Materials. All agencies or subcontractors will have an affirmative procurement program if >$10,000 in supplies purchased annually.
Clean Air Act	The Clean Air Act (CAA) Amendments of 1990 adds to the CAA by establishing two waste minimization-related reporting requirements.
Clean Water Act	The Clean Water Act (CWA) Amendments of 1992 (Section 402p) establishes new regulations related to pollution prevention. Requires National Pollutant Discharge Elimination System (NPDES) permits for discharged water.
Emergency Planning and Community Right-to-Know Act	The head of each Federal agency is responsible for ensuring that all necessary actions are taken for the prevention of pollution with respect to that agency's activities and facilities, and for ensuring that agency's compliance with pollution prevention and emergency planning and community right-to-know provisions.
Energy Policy Act of 1992 (Subtitle F – Federal Agency Energy Management)	Requires DOE to work with other federal agencies to reduce energy use and its environmental impacts. Authorizes efforts to improve energy efficiency and pollution prevention technologies.

Table 1-1. Regulatory drivers

Chapter 2: 2003 Pollution Prevention Results

Metrics

The Pollution Prevention Program improves Laboratory operations with the goal of preventing environmental damage and adverse regulatory findings. In order to assess progress toward that goal the Pollution Prevention Office has developed and DOE has approved a set of performance metrics. Progress is measured against the goals established in the November 12, 1999 Secretary of Energy Memorandum: Pollution Prevention, Energy Efficiency Leadership Goals. The DOE 2005 Pollution Prevention, Energy Efficiency Leadership Goals addressed include:

- Routine hazardous waste minimization,
- Routine low-level waste (LLW) minimization,
- Routine mixed low-level waste (MLLW) minimization,
- Toxic release inventory (TRI) chemical use reduction,
- Routine solid sanitary waste minimization,
- Sanitary material recycling,
- Clean-up/stabilization waste reduction,
- Affirmative procurement (purchase of EPA-designated recycled content items), and
- Replacement of Ozone Depleting Substances (ODS) Class I chillers (>150T).

The measures and associated metrics for all these waste types are presented in Table 2-1. Laboratory performance toward the goals will be measured through an index that combines performance toward individual goals into a single index number expressed as a percentage. A 0 index corresponds to baseline year performance; a 100 corresponds to

	Goal Title	DOE 2005 Goal %	Baseline (year)	2005 Goal	2003 Data	Index
1a	Hazardous waste reduction	90%	307 MT (93)	31 MT	42 MT	96%
1b	LLW reduction	80%	1987 m^3 (93)	397 m^3	707 MT	81%
1c	MLLW reduction	80%	12.3 m^3 (93)	2.46 m^3	5.07 m^3	74%
1d	TRI chemical use reduction	90%	88,293 lbs (93)	8,829 lbs	28,872 lbs	75%
1e	Sanitary waste reduction	50%	240kg/person (93)	120kg/person	111 kg/person	108%
1f	Sanitary material recycling	45%	N/A	45%	73%	162% (110% cap)
1g	Cleanup/stabilization waste reduction	10%	N/A	10%	20%	200% (110% cap)
1h	Affirmative Procurement	100%	N/A	100%	99%	99%
1i	Replace ODS Class I chillers, >150T	100%	2750 T (00)	2750 T	4420 T	161% (110% cap)

	TRU waste	50%	100 m^3	50 m^3	69 m^3	62%
	Overall Index					92.5

Table 2-1. 2003 Performance Index

index using the nine individual goals in this measure. All nine goals are weighted equally.

A comparison of the FY 2003 metrics with last years metrics shows that performance for replacement of Class I ODS, cleanup/stabilization waste, sanitary waste recycling and sanitary waste improved dramatically. TRU waste, MLLW, hazardous waste and affirmative procurement performance are essentially unchanged. LLW level waste generation increased substantially in FY 2003.

The sharp decrease in sanitary waste disposal is due primarily to far better recycling performance and to adoption of a more technically defensible metric.

The increase in LLW generation occured primarily in NMT Division. Periodic maintenance operations generated most of the additional waste. These glovebox maintenance operations occur every few years and invariably generate significant quantities of LLW. Projects to reduce waste generation in each waste area are described in the specific waste area summaries in the next section.

Performance

In this section detailed review and analysis of the 2003 PP performance is presented. Each waste or conservation category is discussed.

TRU WASTE

INTRODUCTION

Transuranic (TRU) waste is waste containing >100 nCi of alpha-emitting TRU isotopes per gram of waste, with half-lives greater than 20 yr. (atomic number greater than 92), except for (1) high-level waste (HLW); (2) waste that the Department of Energy (DOE) has determined, with the concurrence of the Administrator of the Environmental Protection Agency (EPA), does not need the degree of isolation required by Code of Federal Regulations 40 CFR 191; or (3) waste that the United States Nuclear Regulatory Commission (NRC) has approved for disposal on a case-by-case basis in accordance with 10 CFR 61. TRU waste is generated during research, development, nuclear weapons production, and spent nuclear fuel reprocessing.

TRU waste contains radioactive elements such as plutonium, with lesser amounts of neptunium, americium, curium, and californium. These radionuclides generally decay by emitting alpha particles. TRU waste also contains radionuclides that emit gamma radiation, requiring it to be managed as either contact handled or remote handled. Approximately half of the TRU waste analyzed is mixed TRU (MTRU) waste, containing both radioactive elements and hazardous chemicals regulated under the Resource Conservation and Recovery Act (RCRA).

The total volume of TRU waste managed by the DOE—currently in inventory (storage) and projected through 2034 is estimated to be ~171,000 m3. TRU waste is disposed of at the Waste Isolation Pilot Plant (WIPP), a geologic repository near Carlsbad, New Mexico.

TRU waste at the Laboratory can be classified as either legacy waste or newly generated waste. Legacy waste is that waste generated before September 30, 1998. DOE Environmental Management (DOE/EM) is responsible for disposing of this waste at WIPP and for all associated costs. Newly generated waste is defined as waste generated after September 30, 1998; DOE/Defense Programs (DOE/DP) is responsible for disposing of this waste at WIPP. This roadmap focuses only on the newly generated wastes. Within this broad category, newly generated wastes are subdivided further into solid and liquid wastes, as well as routine and nonroutine wastes. Solid wastes include cemented residues, combustible materials, noncombustible materials, and nonactinide metals. Liquid wastes comprise effluent solutions associated with the nitric acid and hydrochloric acid plutonium-processing streams. Because of the final pH of these streams, they are also referred to, and are reported as, the acid and caustic waste streams, respectively. Routine waste is defined as waste produced from any type of production operation, analytical and/or research and development (R&D) laboratory operations; treatment, storage, and disposition facility operations; "work for others"; or any other periodic and recurring work that is considered ongoing in nature.

Nonroutine is defined as one-time operations waste: wastes produced from environmental restoration program activities, including primary and secondary wastes associated with retrieval and remediation operations, legacy wastes, and decontamination and decommissioning (D&D)/ transition operations. TRU and MTRU wastes are reported separately because of the differing characterization requirements applied to them. These requirements are detailed in the RCRA and the Federal Facilities Compliance Order/Site Treatment Plan (FFCO/STP).

The Nuclear Materials Technology (NMT) Division conducts and provides support for scientific research and development on strategic nuclear materials in Category I nuclear facilities, the Plutonium Facility [Technical Area (TA-55-PF4] and the Chemistry and Metallurgy Research (CMR) Facility (TA-3, Building SM-29, in support of the Nation's defense needs. The Division plays a significant role in each of the following major programs:

- Stockpile Management: manufacture and certification of nuclear weapons components.
- Stockpile Stewardship: disassembly and evaluation of nuclear weapons components.
- Materials Disposition: preparation of nuclear materials for long-term storage and the production of MOX fuels.
- Energy: manufacture of heat sources for the Nation's space exploration program.
- Environment: establish technical basis for long-term storage and development of more efficient processes for recovery of nuclear materials.

NMT Division's technical role in these programs is to:

- install the capabilities to manufacture specified pits,
- to produce nuclear materials for manufacture and surveillance,
- to assist in the material characterization in order to understand aging phenomena,
- to disassemble, sample, and evaluate pits,
- and to design and operate prototype facilities for the disposition of excess nuclear materials.

TRU solid wastes are accumulated, characterized, and assayed for accountability purposes at the generation site. TRU solid waste is packaged for disposal in metal 55-gal. drums, 4-x-4-x-6-ft standard waste boxes (SWBs), and oversized containers. Security and safeguards assay measurements are conducted on the containers for accountability before they are removed from PF-4. TRU wastes removed from PF-4 in 55-gal. Drums, Pipe Overpack Containers (POCs) and SWBs are shipped to TA-54, Area G for storage on the same day they are removed. Oversized containers of TRU waste are staged on an asphalt pad behind PF-4 and are shipped to TA-54 within 1 week of removal. Detailed characterization of TRU wastes is performed at TA-54, Building 34, the Radioassay and Nondestructive Testing (RANT) Facility; and at TA-50, Building 69, the Waste Compaction, Reduction, and Repackaging Facility (WCRRF). Samples from drums are sent to the CMR building for characterization in some cases. TRU waste is stored at TA-54, Area G, until it is shipped to WIPP for final disposal. Certification of the waste for transport and disposal at WIPP is the responsibility of the Risk Reduction & Environmental Stewardship (RRES) Division's Transuranic Certification (RRES-CE) and Transuranic Characterization (RRES-CH) Groups. TRU waste shipments to WIPP began on March 25, 1999, and are expected to continue through 2032. RRES Division and FWO Division generate TRU wastes as a direct result of treating, characterizing and certifying NMT-Division-produced waste (both legacy and newly generated). The top-level process map for TRU waste is shown in Figure 2-1.

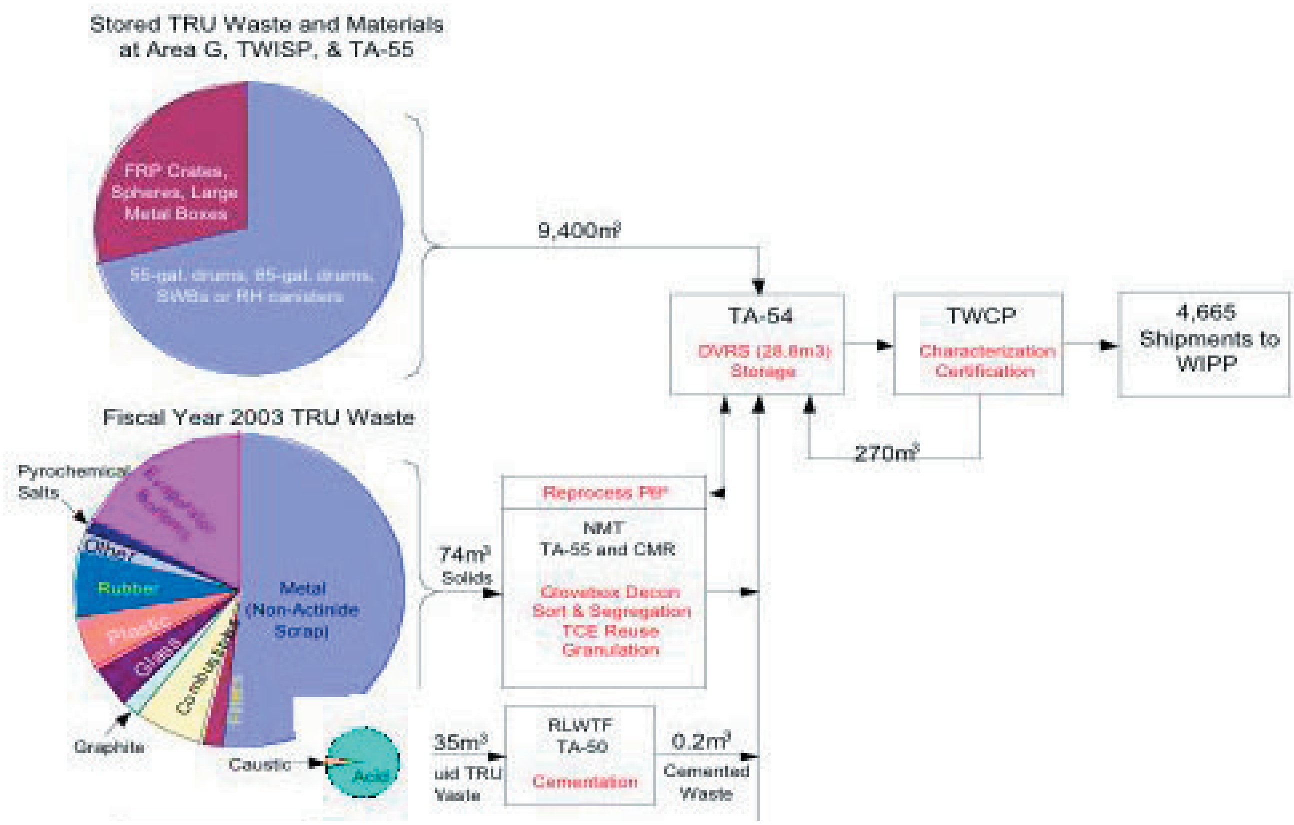


Figure 2-1. TRU Waste Process Chart

Figure 2-2 shows the relative volumes of routine and nonroutine TRU and MTRU generated in FY03 by LANL organizations. All of the RRES TRU waste is secondary (non-routine) waste generated from the certification and repackaging of previously generated TRU waste. The Facility and Waste Operations, Solid Waste Operations (FWO-SWO) TRU waste is solid waste generated from the size-reduction of oversized TRU waste items at the Decontamination and Volume Reduction Facility (DVRS). One drum of FWO-Waste Facility Management (WFM) TRU waste was generated from the treatment of the NMT Division acid and

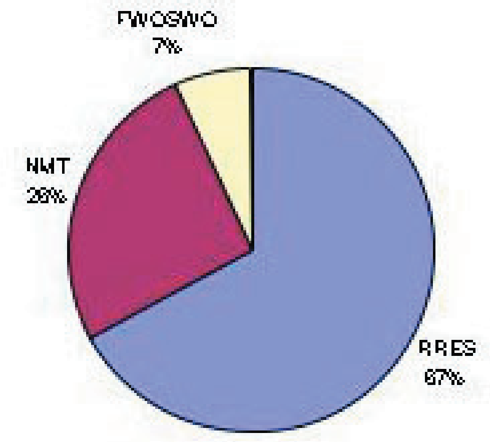


Figure 2-2. TRU and MTRU

caustic waste streams at the Radioactive Liquid Waste Treatment Facility (RLWTF). NMT Division waste was generated from ongoing operations.

The total volume of TRU waste generated by the Laboratory is shown in Fig. 2-3 and is identified as routine, nonroutine, and environmental remediation waste. The Remediation Services (RS)/D&D Program has produced TRU waste intermittently; this waste is related directly to the area or facility being remediated or decommissioned. In FY97, significant quantities were generated because of the D&D of TA-21, which was the old uranium- and plutonium-processing site. On March 16, 2000, a radiological release of 238Pu occurred near a glovebox in Los Alamos National Laboratory's (the Laboratory's) Plutonium Processing and Handling Facility (TA-55). As a result of the subsequent Type A Accident Investigation and the response to that investigation, work within TA-55 was curtailed for the remainder of FY00 and a portion of FY01. The curtailment of operations resulted in artificially low TRU waste generation rates for FY00 and FY01.

TRU Waste Minimization Performance

The DOE 2005 pollution prevention goals require that the DOE complex reduce "routine" TRU/MTRU waste generation by 80% to <141 m3 by 2005. The Laboratory's allocation of that 141 m3 has not been determined but only the Laboratory and the Savannah River Site have ongoing missions related to the use of plutonium. However, the Laboratory must reduce its present generation rate if the DOE is to achieve that goal. Between 1993 and 1998, the amount of TRU waste generated by the Laboratory increased from 76.7 to 121.7 m3 (58%). The volume of routine TRU waste produced by the Laboratory decreased in FY00 and FY01 as a result of unplanned shutdowns of the TA-55 Plutonium Processing Facility. To help achieve the DOE complex-wide goal, the Laboratory set an FY05 performance goal that includes decreasing routine TRU waste generation by 50% to 50m3 from a baseline of 100m3.

Future Goal Compliance

In FY01, NMT Division prepared an integrated TRU Waste Minimization Management Plan

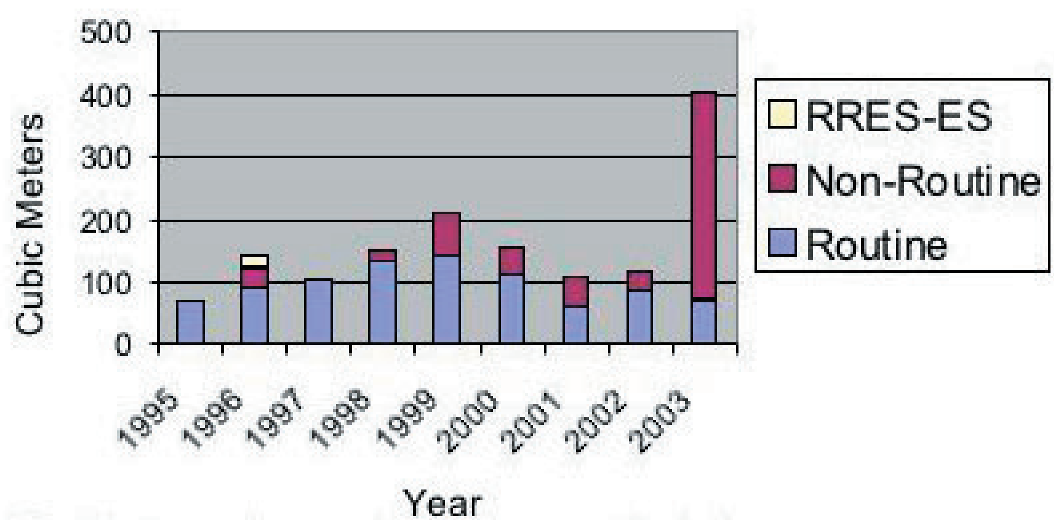


Figure 2-3. Routine and non-routine waste history

that included project descriptions, required technologies, cost, cost savings, waste reduction estimates, and implementation issues for

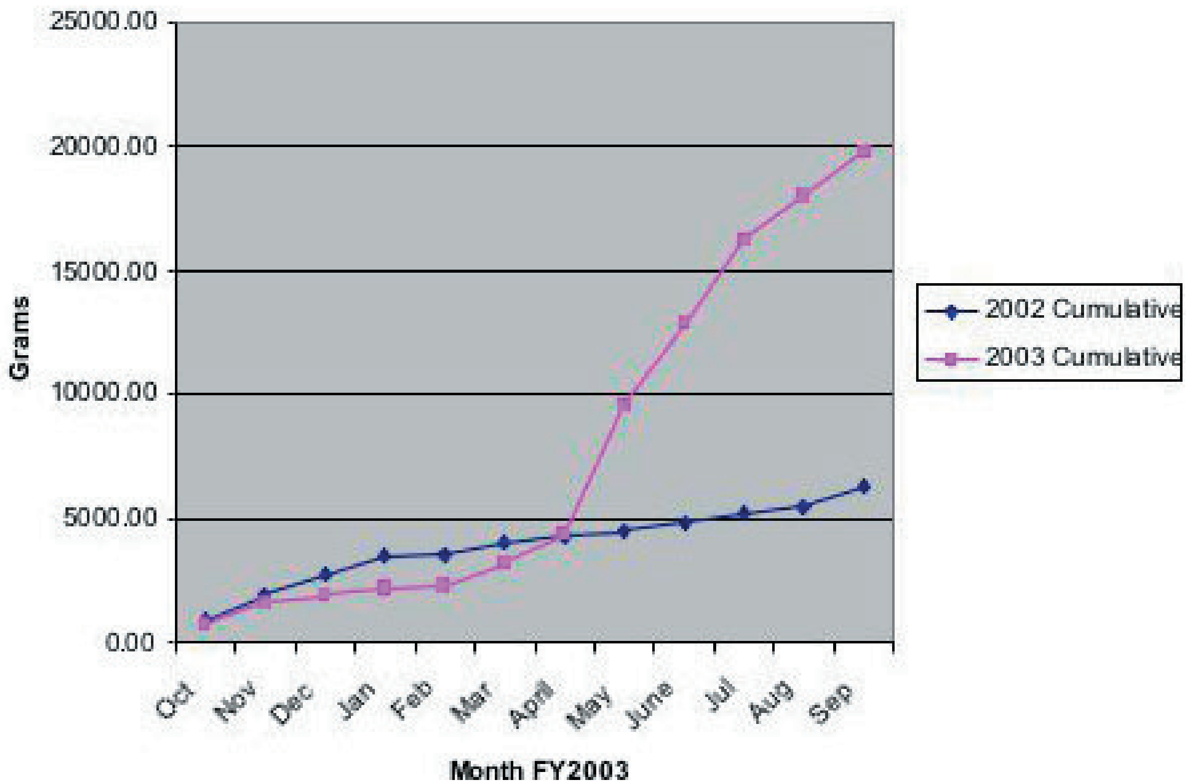


Figure 2-4. Special Nuclear Material Content of TRU Waste Expressed in Fissile Gram Equivalents

a comprehensive set of waste avoidance/ minimization activities specific to NMT Division operations. The NMT Division philosophy and expectations for environmentally conscious plutonium processing are presented in the NMT Division Waste Management Program Plan. The goals of the Waste Management Program Plan were to reduce liquid waste by 90% and essentially to eliminate the combustible waste stream by CY03. Both plans made assumptions regarding annual funding levels and programmatic priorities.

Since the development of NMT Division Waste Management Program Plan, funding for waste minimization projects has not materialized and waste minimization is secondary to the programmatic goals for new projects. Although LANL met its TRU waste minimization goals for FY01 through FY03 further reductions in waste generation may not necessarily result in lower waste volumes. For example, the Defense Nuclear Facilities Safety Board (DNFSB) recommendation 94-1 requires that much of the SNM formerly held in the PF-4 vault for reprocessing be discarded as TRU waste. Although that material is discarded as nonroutine waste, SNM material generated from ongoing activities that would have been held in the vault for reprocessing is also being discarded as routine TRU waste. Because of the actinide concentration of these waste items only a few items can be packaged in each drum before the SNM limit of the drum is reached. Although the volume of the actual waste is quite small, volume of the shipping container (Drum or SWB) is used to calculate waste volume. Figure 2-4 shows the significant increase in SNM contained in TRU waste. Thus a few small waste items are reported as a volume of 0.208m3 (55-gallons) of waste. Most of the "waste volume" is air. This In addition some waste items are being packaged in 55-gallon Pipe Overpack Containers (POCs) to reduce the dose rate to levels acceptable for shipping and storage. The packing inside a POC limits the waste volume to approximately 1/6th of the actual container volume. Minimizing the waste volume further results in an even smaller volume of waste going into each drum.

In addition to the problems associated with the high SNM content of TRU waste, there is the problem of the large planned increases in NMT mission activities. NMT Division has identified three critical efforts in the Laboratory's and Nuclear Weapons (NW) Directorate's missions that require the unique facilities and capabilities of the Division:

1. Integrated Pit Manufacturing and Certification
2. Surveillance and Enhanced Surveillance
3. Disassembly and Material Disposition

Funding within the Division for these efforts were $144M in FY02 and are projected to grow by at least 30% by FY05   Increase in mission activities will inevitably lead to increases in TRU waste volumes. To first order growth in waste volume is proportional to budget growth.

Waste Stream Analysis

TRU wastes are generated within radiological control areas (RCAs). These areas also are material balance areas (MBAs) used for security and safeguards to prevent the potential diversion of special nuclear material (SNM). TRU and MTRU wastes are reported separately because of the different characterization requirements for the wastes. These requirements are detailed in the RCRA and the FFCO/STP—New Mexico Environment Department (NMED), which stipulates treatment requirements for MTRU wastes. In CY99, WIPP received a "No Mitigation Variance," which allows it to accept MTRU waste for disposal without treatment. However, the characterization requirements for MTRU waste remain. MTRU waste can be shipped to WIPP without treatment, except as needed to meet storage and transportation requirements. In the following sections, TRU/MTRU wastes will be discussed as one waste type because the waste minimization strategy for both waste types is the same.

The TA-55 Plutonium Facility processes 239Pu from residues generated throughout the defense complex into pure plutonium feedstock. The manufacturing and research operations performed at TA-55 in the processing and purification of plutonium result in the production of plutonium-contaminated scrap and residues. These residues are processed to recover as much plutonium as is practical. These recovery operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste generated at TA-55.

TRU waste materials, process chemicals, equipment, supplies, and some RCRA materials are introduced into the RCAs in support of the programmatic mission. All SNM introduced into Building PF-4 at TA-55 is stored in the vault in the PF-4 basement until needed for processing. Because of the hazards inherent in the handling, processing, and manufacturing of plutonium materials, all process activities involving plutonium are conducted in gloveboxes. High levels of plutonium contamination can build up on the inside surfaces of gloveboxes and process equipment as a result of the process or because of leaking process equipment. All materials being removed from the gloveboxes must be multiple-packaged to prevent the spread of contamination outside the glovebox. Currently, all material removed from gloveboxes is considered to be TRU waste. Large quantities of waste, primarily solid combustible materials such as plastic bags, cheesecloth, and protective clothing, are generated as a result of contamination avoidance measures taken to protect workers, the facility, and the environment. The relative volumes of that waste are shown in Fig. 2-5.

Combustible Wastes. Combustible wastes comprise ~10% of the TRU waste generated at the Laboratory. For the MilliWatt Heat Source Program, combustible solids account for almost 90% of the TRU wastes contaminated with 238Pu, for which there is currently no disposal pathway.

In all instances, combustible waste comprises

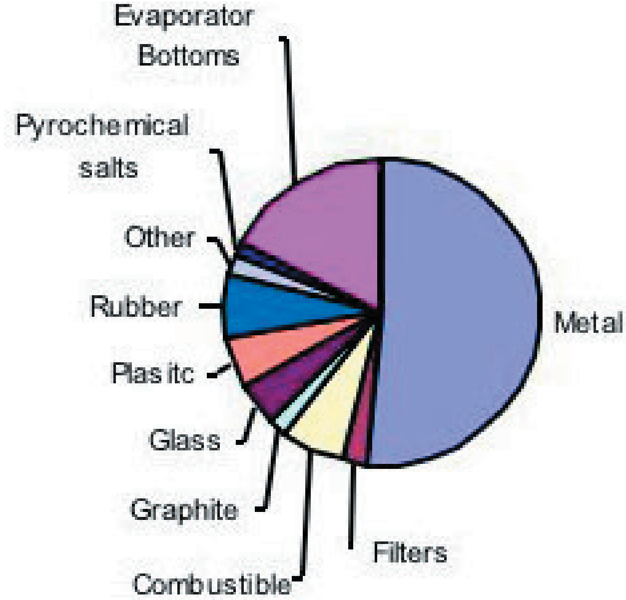


Figure 2-5. Composition of Solid TRU wastefrom NMT Division, FY03.

mostly plastic bags, plastic reagent bottles, plastic-sheet goods used for contamination barriers, cheesecloth, gloves, protective clothing worn by workers, and a small volume of organic chemicals and oils.

Noncombustible TRU Waste. Noncombustible TRU waste includes glass, high-efficiency particulate air (HEPA) filters, graphite, plastic, rubber, or other materials.

Nonactinide Metals. Nonactinide metals are any metallic waste constituents that may be contaminated with, but are not fabricated from, actinide metals. Metallic wastes typically include tools, process equipment, facility piping and supports, and ventilation ducting. Significant volumes of metallic waste are generated under the following conditions: (1) when gloveboxes have reached the end of their useful life, (2) when processes within the facility and glovebox are changed, (3) when routine and nonroutine maintenance activities are completed, and (4) as f acility construction projects are implemented to meet new programmatic missions.

Evaporator Bottoms. Evaporator Bottoms are those acidic and caustic processing sludges and oxalate precipitation residues that contain levels of plutonium exceeding the STLs but containing less than the values requiring reprocessing. Before being discarded, these residues must be immobilized to minimize their potential attractiveness for diversion. Cementation meets this immobilization requirement. The high concentrations of actinides in this sludge frequently exceed the thermal wattage limit for WIPP disposal and require dilution by as much as a factor of five to meet certification requirements.

Implementation of vitrification for this waste stream will reduce the final volume by a factor of four.

Caustic and Acidic Liquid Waste. Caustic liquid waste results from the final hydroxide precipitation step in the aqueous chloride process. Feedstocks for this process typically are anode heels, chloride salt residues, and other materials having a relatively high chloride content. Acidic liquid waste is derived from processing plutonium feedstock with nitric acid for matrix dissolution. Following oxalate precipitation, the effluent is sent to the evaporator, where the overheads are removed and sent to the acid waste line for further processing at the TA-50 RLWTF. Evaporator bottom sludge is cemented into 55-gal. drums for disposal.

	CY1998	CY 1999	CY 2000	CY 2001	CY 2002
Caustic Waste Treated in Liters	0	7,931	3,816	11,607	1,684
Acid Waste Treated in Liters	41,930	40,364	11,847	15,500	33,719

Table 2-2. Volumes of Liquid TRU Waste Treated at the TA-50 RLWTF

Liquid TRU wastes from the acidic and caustic processes are transferred from TA-55 to the TA-50 RLWTF via separate, double-encased transfer lines for processing. The processed waste is cemented into 55-gal. drums and transported to TA-54 for storage and ultimate disposal at WIPP as TRU solid waste. Table 2-2 shows the volume of liquid TRU waste that was processed at the TA-50 RLWTF. In FY02 95% of the liquid TRU waste came from the acid waste stream and the remaining 5% from the caustic waste stream. Implementation of the Nitric Acid Recovery System (NARS) initially reduced the volume of the acidic waste stream when it went online. However the quality requirements of the Mixed Oxide Fuel (MOX) program do not currently allow the use of recycled acid. The MOX program is the largest generator of acid waste and hence the volumes have increased.

The cost for handling, storage, and disposal of TRU waste was estimated at ~$58,000/m3 in FY01. However, that cost did not include the fixed cost of the storage facility at TA-54 or the cost to open and operate WIPP (fixed disposal cost).

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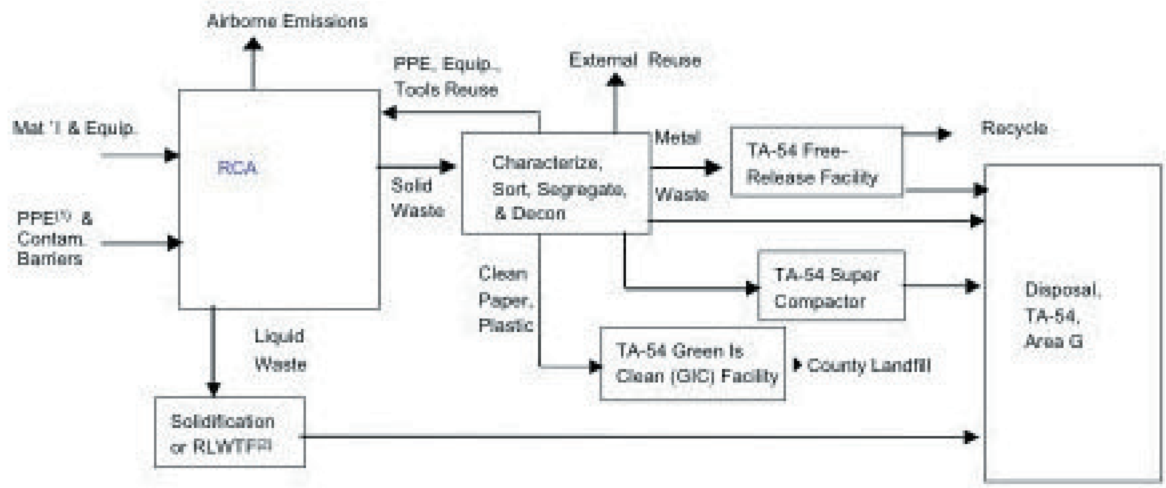
Low-Level Waste

Introduction

Low-level waste (LLW) is defined as waste that is radioactive and is not classified as high-level waste (HLW), transuranic (TRU) waste, spent nuclear fuel, or by-product materials (e.g., uranium or thorium mill tailings). Test specimens of fissionable material irradiated only for research and development and not for the production of power or plutonium may be classified as LLW, provided that the activity of TRU waste elements is <100 nCi/g of waste.

Disposal of LLW is governed at Los Alamos National Laboratory (the Laboratory) by its and radiological characteristics of acceptable LLW and are developed from Department of Energy (DOE) Orders, federal and state laws and requirements, and site characteristics. Laboratory Implementation Requirement (LIR) 404-00-05.1, Managing Radioactive Waste, provides guidance specific to LLW; and LIR 404-0002.2, General



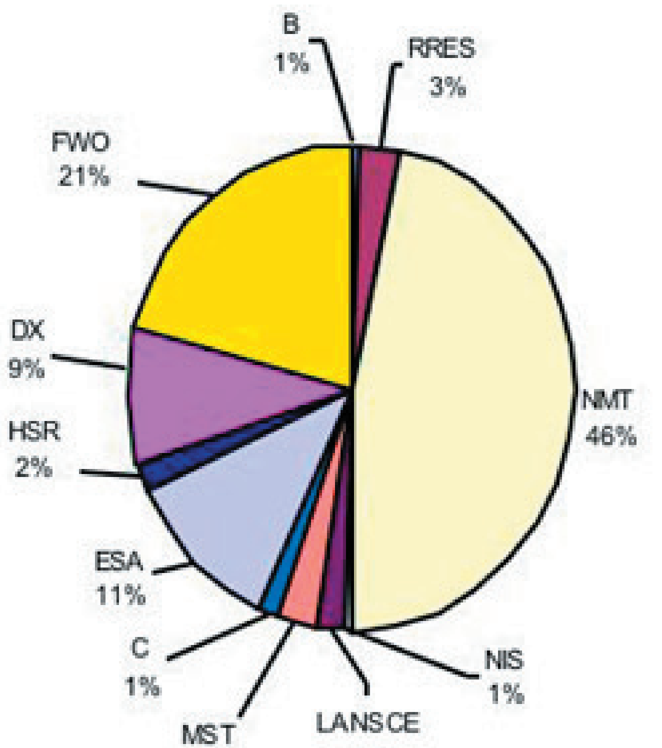


Figure 2-7. LLW generation by Division

waste acceptance criteria (WAC), which also drives LLW reporting requirements. These criteria place limits on the physical, chemical,

Figure 2-6. LLW Process Map

Waste Management Requirements, contains waste minimization requirements.

Figure 2-6 depicts the process map for LLW generation at the Laboratory.

Routine LLW generation by division is depicted in the pie chart in Figure 2-7. Nuclear Materials Technology (NMT) Division and Facility and Waste Operations (FWO) Division generate the largest quantities of routine LLW. The routine solid LLW generation values for each division are listed in Table 2-3.

Division	Total (m3)
B (Bioscience)	5.65
RRES (Risk Reduction and Environmental Stewardship)	21.00
NMT (Nuclear Materials Technology)	330.66

NIS (Nonproliferation and International Security)	4.40
LANSCE (Los Alamos Neutron Science Center)	12.74
MST (Materials Science and Technology)	21.10
C (Chemistry)	9.25
ESA (Engineering Sciences and Applications)	81.85
HSR (Health, Safety, and Radiation Protection)	14.00
DX (Dynamic Experimentation)	62.21
FWO (Facilities and Waste Operations)	151.23
Total	714.9

Table 2-3. LLW generation by division

Low-Level Waste Performance

The DOE has specific goals for waste minimization under the DOE Pollution Prevention Energy Efficiency (P2E2) Secretarial Goals.

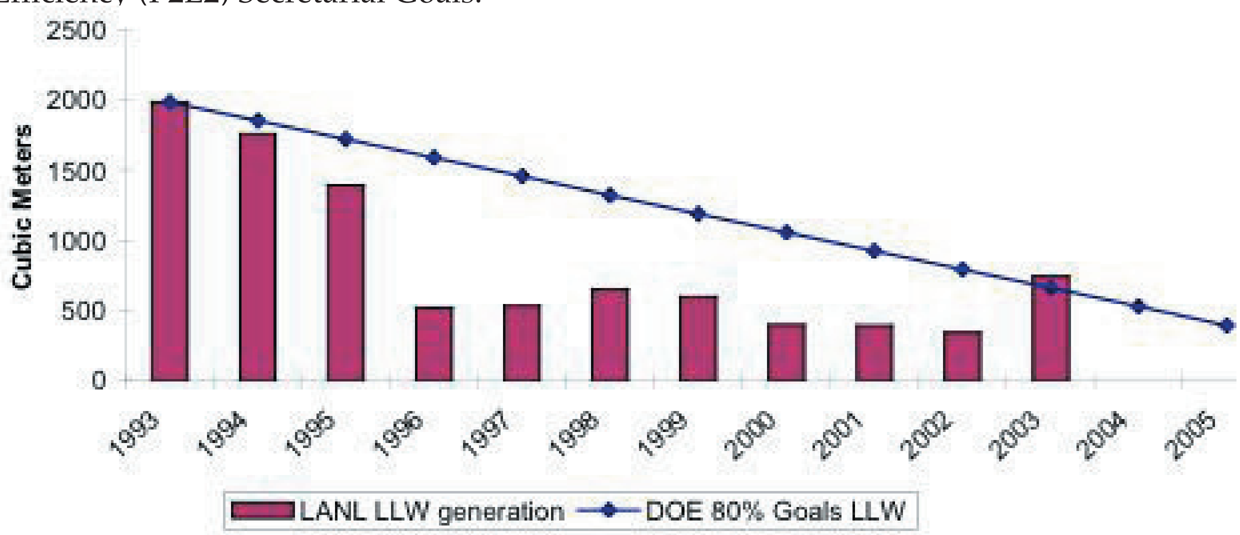


Figure 2-8. LLW generation by year

Further, DOE Order 450.1 requiring implementation of Environmental Management Systems (EMS) requires that DOE sites go beyond compliance requirements and implement continuous and cost-effective improvements. To achieve these objectives, the Laboratory will use an EMS to evaluate environmental hazards and define the highest-priority hazards and the most cost-effective solutions to reduce the environmental impacts from these hazards.

As required by DOE, the LLW reduction goal for fiscal year (FY)05 is to reduce waste from routine operations by 80% by 2005, which will be calculated using calendar year (CY)93 as the baseline. Figure 2-8 shows the Laboratory's LLW generation since 1993. Values for the volume of routine waste subsequent to FY01 include reductions due to compaction. In previous years, the values did not include these reductions.

The graph shows that the Laboratory met the FY-05 waste reduction goal in previous years. However, in FY-2003, the Laboratory has experienced a sharp increase in LLW generation. This increase was caused by a number of factors. These factors are listed below.

- Cost codes have been used in recent years to determine if waste generation is routine or non-routine. Unfortunately, for divisions that have integrated their waste management activities, all waste is disposed of under a single cost code. This makes it impossible to determine if the waste generation was routine or non-routine in the majority of cases. In FY-03, NMT Division generated 268 cubic meters of non-compactable LLW. A large portion of this waste was generated from legacy cleanouts to make room for new activities and from facility reconfiguration activities. As much as 100 cubic meters of this waste should have been designated as non-routine. Unfortunately, these activities are scheduled to continue in FY-04.

• Closure of the TSTA (Tritium Systems Test Assembly) Facility at TA-21 generated 25.2 cubic meters of LLW. This is considered a one-time waste generation activity and will not continue in FY-04.

• RRES Division generated 31.49 cubic meters of waste from the disposal of empty drums that previously contained TRU waste. This was a one-time waste generation activity caused by the movement of operations from TA-50 to TA-54.

• DX division generated 59.54 cubic meters of LLW from a new requirement to confine testing activities. This activity is expected to continue into FY-04.

• FWO division generated 151.23 cubic meters of LLW. This volume is an increase of about 100 cubic meters over FY-02 values. The increase is due to an increased volume of one-time waste from the RLWTF, one-time waste from excess facilities, and treated waste returned for disposal. Of the 100 cubic meters total, only 50 cubic meters is expected as a potential increase to FY-04 volumes.

Reducing the FY-03 waste volumes by values for one-time waste generation and non-routine waste inadvertently classified as routine, yields a revised value of 538 cubic meters. This value is still significantly above FY-02 waste generation values. Specific projects to reduce FWO and DX division wastes will be required to return the waste generation values to FY-02 levels and to meet the DOE FY-05 goals.

Waste Stream Analysis

Materials, hardware, equipment, personnel protective equipment (PPE), and contamination barriers (paper and plastic) are used in radiological control areas (RCAs). After these items are no longer needed, they leave the RCA after being sorted, segregated, and, if possible, decontaminated. Some PPE, equipment, and tools are reused at the Laboratory, whereas other equipment is sent off site for reuse. Compactable waste is sent to the Technical Area (TA)-54, Area-G compactor for volume reduction before disposal. Much of the waste leaving RCAs is not radiologically contaminated and can be surveyed to determine if the waste meets the radiological release criteria. If so, it is recycled or disposed of as sanitary waste. Low-density waste is sent to the GIC Facility at TA-54, Area G for verification that it meets the radiological release criteria. It then is sent to the County Landfill for disposal. The LLW streams are broken down by percent in Fig. 2-9.

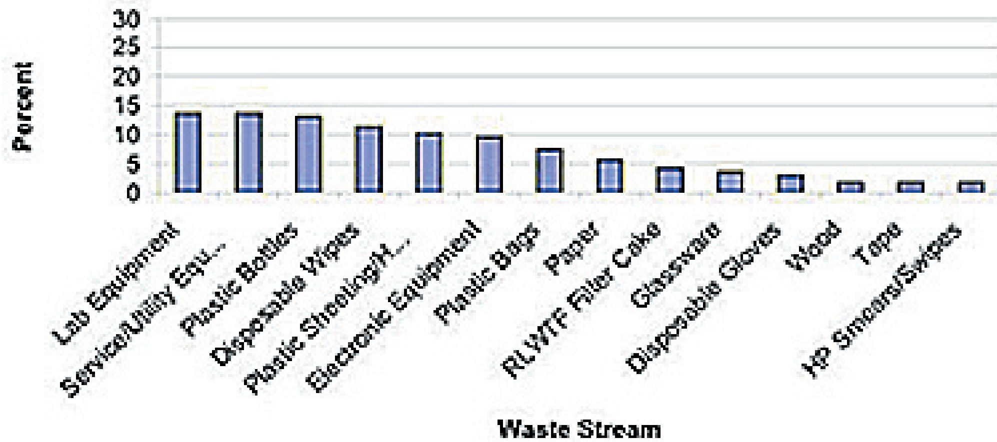


Figure 2-9. Routine LLW streams

Solid LLW generated by the Laboratory's operating divisions is characterized and packaged for disposal at the onsite LLW disposal facility at TA-54, Area

G. LLW minimization strategies are intended to reduce the environmental impact associated with LLW operations and waste disposal by reducing the amount of LLW generated and/or by minimizing the volume of LLW that will require storage or disposal on site. LLW minimization is driven by the finite capacity of the onsite disposal facility and by the requirements of DOE Order 435.1 and other federal regulations and DOE Orders.

Liquid LLW typically is generated at the same facilities that generate solid LLW. It is transferred through a system of pipes and by tanker trucks to the RLWTF at TA-50, Building 1. The radioactive components are removed and disposed of as solid LLW. The remaining liquid is discharged to a permitted outfall.

Unlike other waste, waste produced from decommissioning and environmental services (RS) projects will be disposed of either at the Envirocare site in Utah, in situ, or at Area G and is not addressed in this LLW section.

Solid LLW comprises various waste streams that are categorized as combustible LLW, noncombustible LLW, and scrap-metal LLW. LLW is generated when materials, equipment, air, and water brought into RCAs to assist in performing work are contaminated radiologically and then removed from the facility in the form of air emissions, solid LLW, or aqueous LLW.

The LLW streams at the Laboratory arise from processes at various Laboratory sites and are often interrelated with other waste forms. For example, significant quantities of Laboratory equipment (e.g., computers) contain circuit boards that must be disposed of as MLLW. The goal of the TRU program is to lower the radiation levels of gloveboxes from TRU to LLW levels through decontamination; the goal of the LLW program is to use all means possible to release the maximum materials for recycle, reuse, or sanitary waste disposal. LLW streams are categorized in the following subsections as combustible, noncombustible, or scrap metal. The categorized waste streams and their definitions follow.

Combustible Waste Streams

Materials from combustible waste streams used to accomplish programmatic work in RCAs are processed as LLW when they are removed. Combustible materials make up ~55% of the routine LLW produced at the Laboratory annually. Combustible LLW streams and their definitions follow in descending order by volume.

Plastic Bottles. Plastic bottles are used to contain aqueous samples and move aqueous material from one RCA to another.

Disposable Wipes. Disposable wipes consist of any absorbent product (paper towels, wipes, cheese cloth, etc.) used as a cleaning aid or to absorb aqueous materials. Most of these wipes either are used as laboratory aids or are contaminated during cleanup activities.

Plastic Sheeting/Herculite. Plastic sheeting is used for contamination barriers. Typically, it is placed on the floor areas or used to build containment structures around equipment to prevent the spread of radioactive contamination and to ease cleanup activities.

Plastic Bags. Plastic bags are used to package waste for disposal and to transport materials from one RCA to another.

Paper. Office paper is used for recording data, working procedures, etc. Other forms of paper, such as brown wrapping paper, are used as temporary contamination barriers to prevent the spread of contamination and to ease cleanup activities.

RLWTF Filter Cake. The RLWTF uses a ferric chloride flocculation agent to precipitate contaminates as part of the treatment process for the radioactive liquid effluent. This waste stream consists of the filter cake that results from this process.

Disposable Gloves. Disposable gloves are an essential PPE requirement when working in RCAs. Disposable gloves offer a high level of dexterity. If more protection is required, a heavier, more launderable pair of gloves can be worn over the disposable gloves.

Wood. Wood is used as a construction material to erect temporary containment structures. It is introduced into RCAs in the form of wooden pallets, scaffolding planks, and ladders. Wood also is used to support heavy objects being packaged for disposal to ensure that the objects do not shift in their packing container during transport.

Tape. Tape serves many purposes within RCAs, such as to seal PPE. It is also used to fix plastic and paper contamination barriers in place.

HP Smears/Swipes. This material consists of filter paper and large "masslin" swipes used to monitor removable contamination levels within RCAs.

Noncombustible Waste Streams

Noncombustible materials make up ~45% of the routine LLW produced at the Laboratory annually. Noncombustible LLW streams are defined in the following list.

Laboratory Equipment. This waste stream consists of a variety of laboratory equipment that is either outdated, no longer functional, or unusable. This waste stream consists of hot plates, furnaces, centrifuges, computers, and a variety of miscellaneous analytical instrumentation.

Building Service/ Utility Equipment and Tools. This waste stream consists of a variety of work tools, as well as equipment used to provide basic facility services, such as pumps, ventilation units, and compressors. This equipment generally is removed during facility maintenance or upgrade activities.

Electronic Equipment. This waste stream consists of a variety of equipment, including computer, miscellaneous laboratory and building services, and utilities electronic equipment. This equipment is expensive to dispose of because it is difficult to characterize and because many of the components are classified as hazardous waste; therefore, this equipment must be either disposed of as MLLW or recycled.

Glassware. This waste stream consists of laboratory glassware that no longer can be used because it cannot be cleaned well enough to prevent the cross contamination of samples.

Mixed Low-Level Waste

Introduction

For waste to be considered mixed low-level waste (MLLW), it must contain Resource Conservation and Recovery Act (RCRA) materials and meet the definition of radioactive LLW. LLW is defined as waste that is radioactive and is not classified as high-level waste (HLW), transuranic (TRU) waste, spent nuclear fuel, or by-product materials (e.g., uranium or thorium mill tailings).Test specimens of fissionable material irradiated only for research and development (R&D) and not for the production of power or plutonium may be classified as LLW, provided that the activity of TRU waste elements

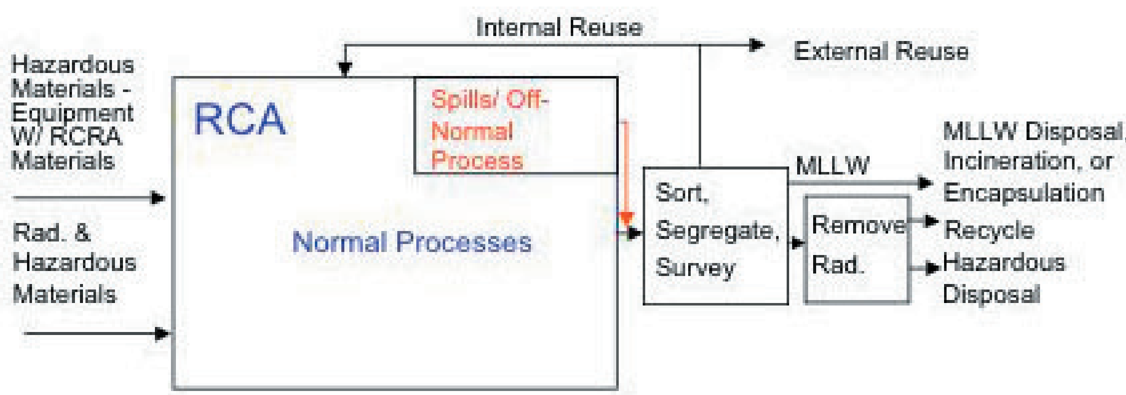


Figure 2-10. MLLW process map

is <100 nCi/g of waste. Because MLLW contains radioactive components, it is regulated by Department of Energy (DOE) Order 435.1. Because it contains RCRA waste components, MLLW also is regulated by the State of New Mexico through

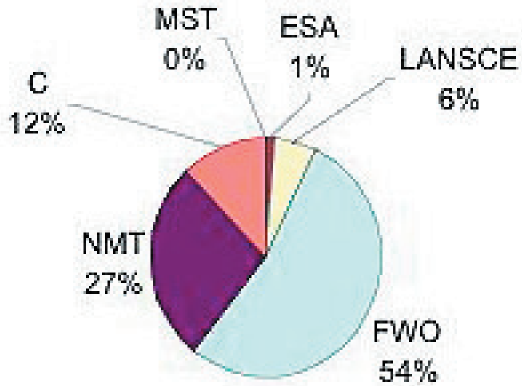


Figure 2-11 . MLLW generation by Division

Los Alamos National Laboratory's operating permit, the Federal Facility Compliance Order/Site Treatment Plan (FFCO/STP) provided by the New Mexico Environment Department (NMED), and the Environmental Protection Agency (EPA). Materials in use that will be RCRA waste upon disposal are defined as hazardous materials.

Most of the Laboratory's routine MLLW results from stockpile stewardship and management and from R&D programs. Most of the nonroutine waste is generated by off-normal events such as spills in legacy-contaminated areas. Remediation Services (RS) and waste management legacy operations, which also produce MLLW, are not included in this chapter of the roadmap. Typical MLLW items include contaminated lead-shielding bricks, R&D chemicals, spent solution from analytic chemistry operations, mercury-cleanup-kit waste from broken fluorescent bulbs and mercury thermometers, circuit boards from electronic equipment removed from a TRU waste radiation area, discarded lead-lined gloveboxes, and some contaminated water removed from sumps.

Figure 2-10. shows the process map for MLLW generation at the Laboratory.

Routine waste generation by division is displayed in Fig. 2-11.

Facility and Waste Operations (FWO), Nuclear Materials Technology (NMT), and Chemistry Divisions were the largest producers of routine MLLW in fiscal year (FY)03. The biggest contributor to the routine waste volume was nitric acid from bioassay activities (FWO). The largest contributor to NMT division waste volumes was paint debris, lead, and spent chemicals. Spent chemical waste was the largest contributor to the C division waste volumes.

Routine MLLW generation is shown by year in Fig. 2-12.

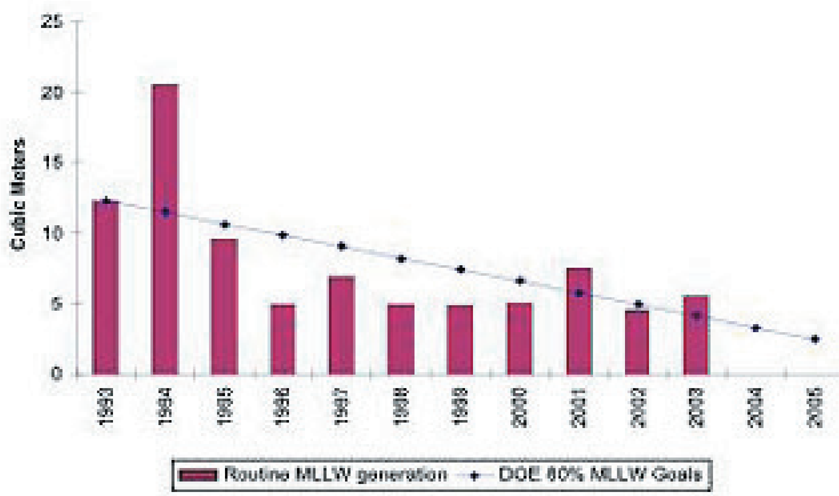


Figure 2-12. Routine MLLW generation trend vs. DOE goal

MLLW Minimization Performance

The DOE has implemented goals for waste minimization. The DOE-proposed MLLW goal is to reduce MLLW from routine operations by 80% by 2005 using calendar-year (CY)93 as the baseline. Because the MLLW generation in the baseline year was a low 12.3 m3, the proposed

DOE FY05 goal would be a very low 2.5 m3. MLLW generation at the Laboratory is currently only 5.5 m3/yr. The Laboratory has proposed or is implementing MLLW reduction projects that could reduce MLLW generation over the next 4 years. These projects include elimination RCRA hazardous paint strippers, solidification of MLLW hydraulic oils, improvements in chemical analysis processes, and elimination of nitric acid bioassay wastes. The Laboratory will continue to make every effort to reduce the MLLW generation to the lowest possible level consistent with funding and operational constraints.

Figure 2-12 shows the Laboratory's progress toward achieving this goal. For the past 3 years, the Laboratory has averaged ~5.75 m3 of MLLW. The spike in waste generation of 7.45 m3 that occurred in FY01 was caused by FY99 and FY00 waste that was placed in the Site Treatment Plan (STP) but not yet received at the disposal site at Technical Area (TA)-54, Area G. All of this waste was added to the FY01 generation rate to avoid further complication of the waste accounting system. The actual FY03 generation was 5.5 m3. With the completion of the nitric acid bioassay waste project in FY-03, the Laboratory expects that the MLLW generation will drop to less than 3 m3 in FY-04.

Waste Stream Analysis

Routine MLLW is generated in radiological control areas (RCAs). Hazardous materials and equipment containing RCRA materials, as well as MLLW materials, are introduced into the RCA as needed to accomplish specific activities. In the course of operations, hazardous materials become contaminated with LLW or become activated, becoming MLLW when the item is designated as waste.

Typically, MLLW is transferred to a satellite storage area after it is generated. Whenever possible, MLLW materials are surveyed to confirm the radiological contamination levels; if decontamination will eliminate either the radiological or the hazardous component, materials are decontaminated and removed from the MLLW category.

Waste classified as MLLW is managed in accordance with appropriate waste management and Department of Transportation (DOT) requirements and shipped to TA-54.

From TA-54, MLLW is sent to commercial and DOE treatment and disposal facilities. The waste is treated/disposed of by various processes (e.g., segregation of hazardous components and macroencapsulation or incineration).

In some cases, the Laboratory procures spent MLLW materials from other DOE/commercial sites. For example, in FY01 the Los Alamos Neutron Science Center Experiment (LANSCE) designed several new beam stops and shutters from lead. Rather than fabricating these from uncontaminated lead, LANSCE received these parts at no expense from GTS Duratek (formerly SEG), a company that processes contaminated lead from naval nuclear reactor shielding. Duratek fabricates parts at no cost to the Laboratory because their fabrication costs are much less than those of MLLW lead disposal.

The largest FY03 waste streams are generated from bioassay waste. These waste streams constitute over 50% of the MLLW waste type and are the primary targets for reduction or elimination. The individual waste streams are as follows.

Bioassay Solution (2.9 m3). This waste is generated by the Laboratory's ongoing bioassay program, which analyzes urine samples from nuclear workers for health protection purposes. The waste consists of assay reagents, which are typically rich in nitrates and trace quantities of radionuclides. Previously, this waste stream was disposed of at the Radioactive Liquid Waste Treatment Facility (RLWTF). To meet new nitrate regulatory limits, the nitrate waste is being collected in carboys for offsite disposal. A project to eliminate this waste was completed in FY-03.

Electronics and Lead (0.44 m3). This waste stream consist of electronic equipment, lead, and lead contaminated debris (lead solder joints on copper pipe).

Paint and Painting Debris (0.42 m3). This waste consists of leftover, unused paint and items such as rags and stirrers that are contaminated with paint.

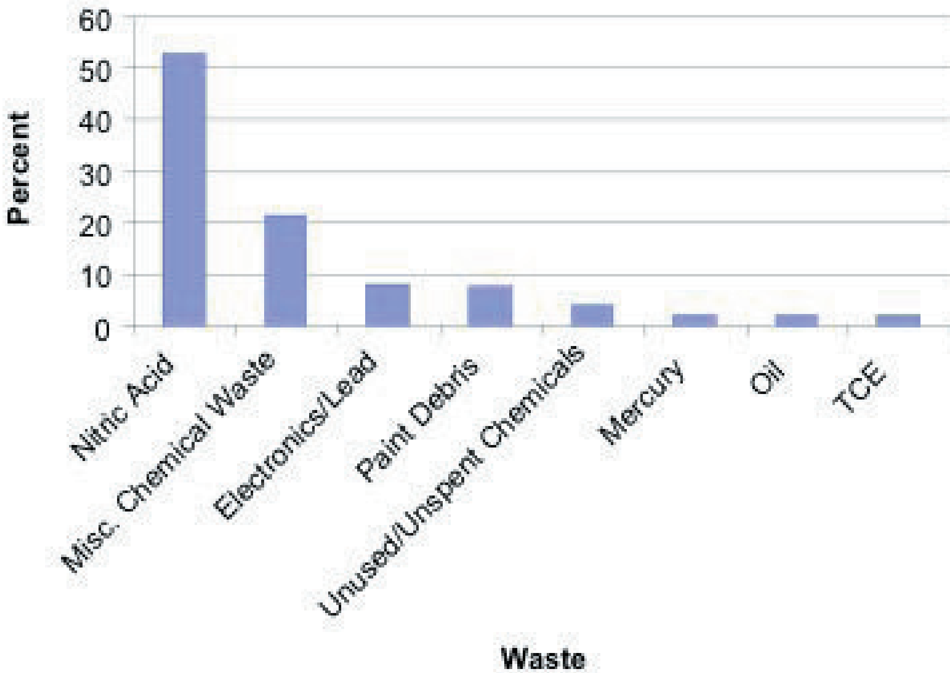


Figure 2-13. MLLW Streams

Unused/Unspent Chemicals (0.21 m3). This waste consists of unused/unspent chemicals that have become radiologically contaminated.

Mercury (0.11 m3). This waste consist of elemental mercury and mercury contaminated debris.

Trichloroethylene (TCE) (0.11 m3). This waste consists of spent TCE solvent used in cleaning weapons components.

Oil (0.11 m3). This waste consists of used vacuum pump and other equipment oil. This waste stream has been significantly reduced in recent years by replacing oil filled vacuum pumps with oilless vacuum pumps.

Efforts to substitute alternatives and to improve sorting and segregation of these waste streams will

reduce these volumes dramatically in the coming years. Nitric acid waste, paint/paint debris waste, and MLLW electronics are ongoing waste streams for which substantial improvement is possible. Improvement projects have been proposed that will lead to a reduction in MLLW. In the following sections, these projects are discussed.

MLLW costs an average of \$36.84/kg to characterize, treat, and dispose of in FY03.

Waste is disposed of either by incineration or by macro-encapsulation and land disposal. Macro-encapsulation involves potting the waste (typically solid parts) in a suitable plastic and creating a barrier around the waste.

The relative size of the various waste streams, expressed in percent, is shown in Fig. 2-13.

A small fraction of the MLLW generated has no disposal path. Typically, this waste is radiologically contaminated mercury or mercury compounds.

Radioactive Liquid Waste

Introduction

For the purposes of this analysis, radioactive liquid waste (RLW) is defined as all waste influent to the Radioactive Liquid Waste Treatment Facility (RLWTF) located at TA-50. The RLWTF has been treating aqueous low-level wastewaters from Los Alamos National Laboratory (LANL, or the Laboratory) facilities since 1963 and is capable of treating in excess of 20,000,000 liters per year (LPY) of wastewater. Some 1800 drains and other sources

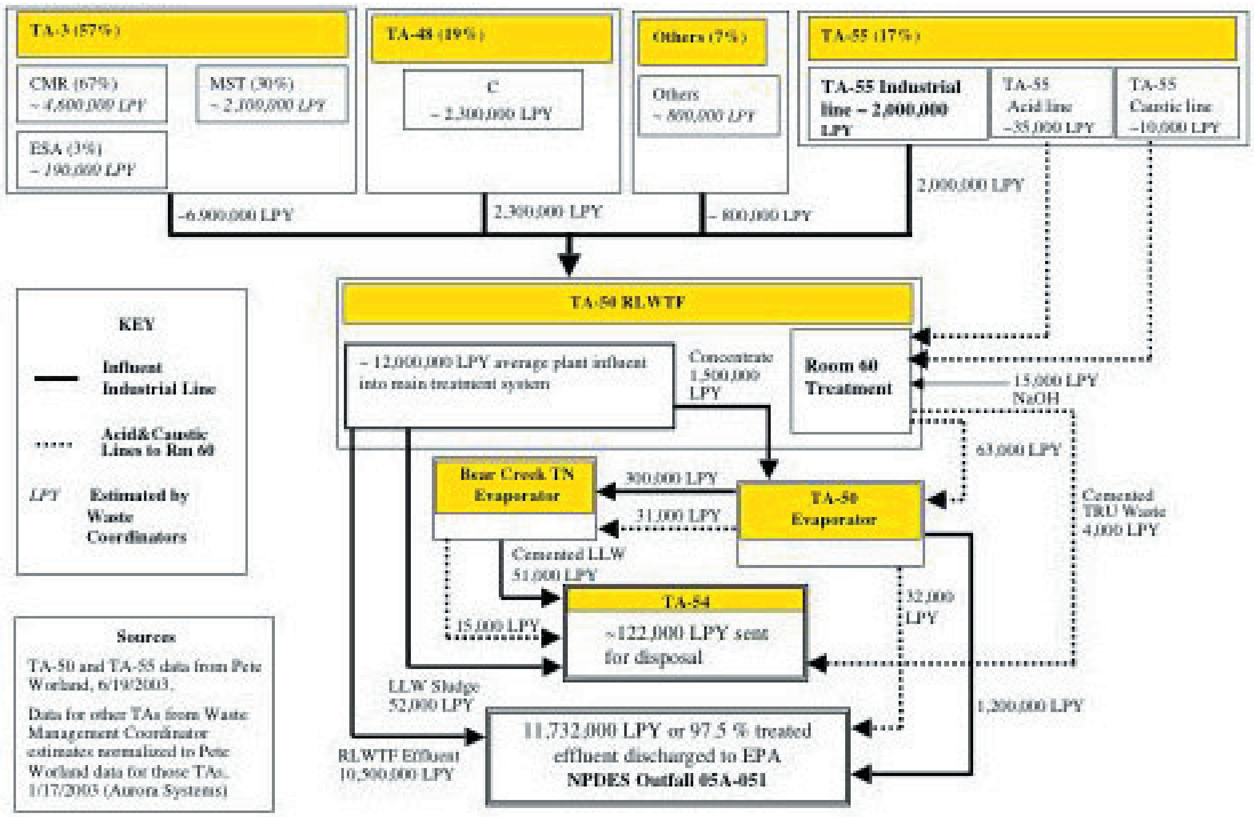


Figure 2-14. RLW Process Map

attached to the RLW industrial collection system connect 15 technical areas (TAs), 13 facility management units, and 62 buildings to the TA-50 plant. TAs 16, 21, and 54 do not have direct connections to the main RLW industrial waste line, and any wastes from these areas are trucked to the TA-50 plant. The remainder of the Laboratory's TAs discharge wastewater directly to the RLWTF through the plant's main industrial line. Much of the wastewater discharged to the RLWTF industrial wastewater line is not radioactive. In addition to the main industrial wastewater line, two smaller lines connect TA-55 with TA-50 and carry exclusively acid and caustic radioactive wastes. Figure 2-14 shows the process map for RLW generation.

RLW is generated at numerous sites, Because the site that is generating RLW is usually known, it is sometimes possible to segregate the waste by division at sites where groups from only one division are present; however, in some cases, groups from more than one division are present at a site. Because the efflent from the entire site is metered, it is not possible to determine with 100% certainty the contributions of the various divisions at the site. In those cases, estimates based on operational experience are made. For example, both Nuclear Materials Technology (NMT) and Chemistry (C) divisions contribute to the Chemistry and Metallurgy Research (CMR) Facility RLW total; however, because the C Division contribution is small compared with the

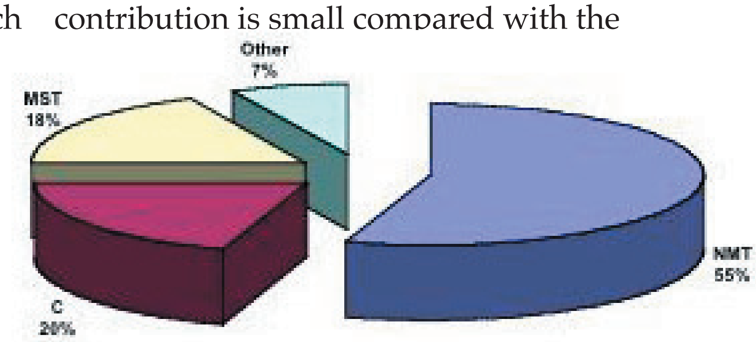


Figure 2-15. RLW generation by Division

NMT total, all CMR waste is assigned to NMT. In cases where reasonable estimates can be made regarding waste volumes by division, they have been made. The resulting fiscal-year (FY)02 allocation of RLW by division is shown in Fig 2-15.

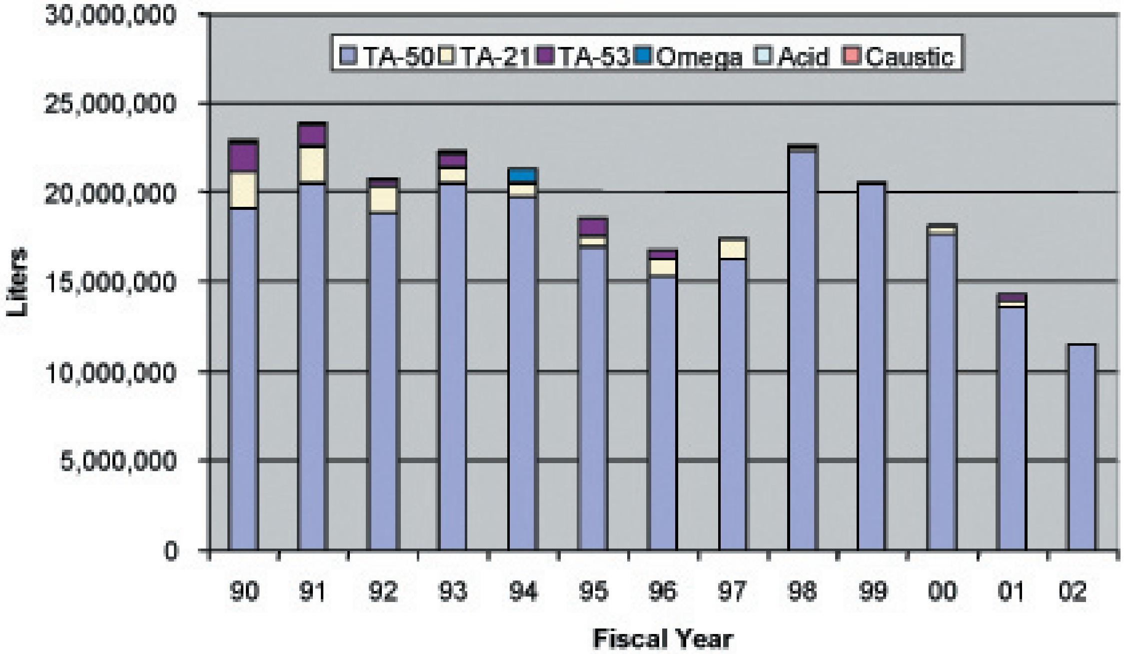


Figure 2-16. RLW generation history

RLW PERFORMANCE

The Department of Energy (DOE) has not implemented specific goals for RLW performance.
RLW treatment and discharge is regulated by the New Mexico Environment Department (NMED) under the Clean Water Act

The generation and discharge of RLW has been decreasing steadily over the last 4 years, primarily due to aggressive minimization practices. RLW generation for the last 12 years is shown in Fig. 2-16 .

The average generation of RLW waste over the past 12 years has been ~20 million LPY. Volumes have been trending lower for the past 4 years because the Laboratory's waste minimization program has removed several nonradioactive sources from the RLW collection system.

WASTE STREAM ANALYSIS

Many processes at LANL produce RLW. However, most of the waste produced falls into one of three categories: acid waste, caustic waste, or "industrial" waste. The acid and caustic waste lines account for most of the curie content of the RLW stream. The industrial waste includes large quantities of liquid waste that contain either no radiation or very dilute radiation.

Acid Waste: Acid liquid waste is derived from

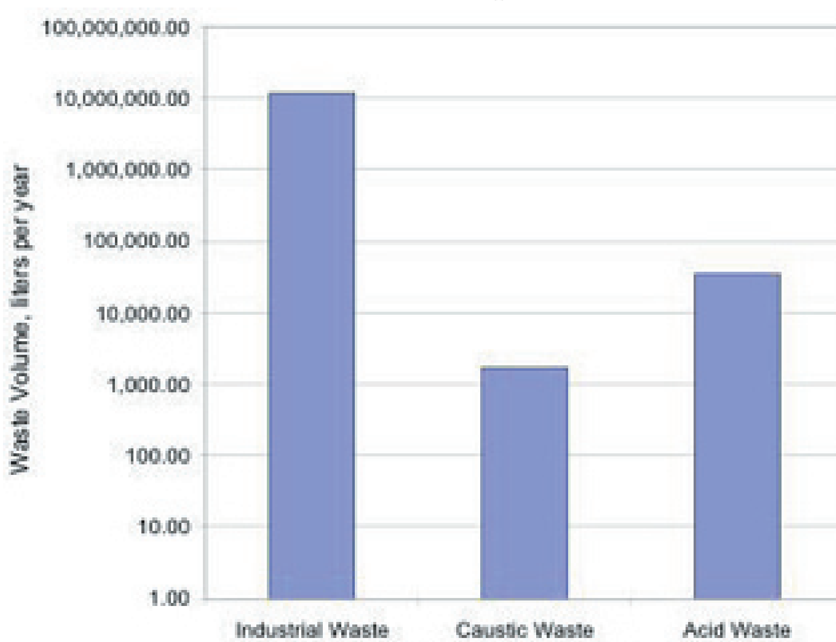


Figure 2-17. Relative RLW volumes

processing plutonium feedstock at TA-55

nitric acid for matrix usingdissolution. Following oxalate precipitation, the effluent is sent to the evaporator, where the overheads are removed and sent via the acid waste line to TA-50 RLWTF, Room 60, for final processing. The acid waste stream must be neutralized before treatment, which requires the addition of sodium hydroxide. The total effluent is increased because of the addition of neutralizing sodium hydroxide. The acid waste stream is expected to increase dramatically in FY03 due to increased processing in the mixed oxide recovery program and then to decrease sharply beginning in mid-FY04 as the Nitric Acid Recycle System (NARS) comes on line and more acid is recycled. The actinide-processing-and-recovery, pit-fabrication, and mixed-oxide waste programs produce most of the acid waste.

Caustic Waste: Caustic liquid waste results from the final hydroxide precipitation step in the aqueous chloride process. Feedstocks for this process typically are anode heels, chloride salt residues, and other materials having a relatively high chloride content generated at TA-55. Efforts are underway to upgrade the throughput capabilities of the aqueous chloride process to handle the increased quantities of chloride residues that will result from working off legacy waste under the 94-1 Residue Stabilization Program. Caustic process liquids are transferred to the TA-50 RLWTF, Room 60, for final processing via the caustic waste line. Over the next 3 to 5 years, throughput quantities are expected to increase. The Nuclear Material Stabilization and Packaging Project, the Actinide-Processing-and-Recovery Project, and the Mixed Oxide (MOX) Project produce most of the caustic waste.

Industrial Waste: Industrial waste is any RLW that reaches TA-50 through the industrial waste line. Industrial waste includes liquid waste from TA-3, TA-48, TA-55, and TA-59. As pointed out previously, much of the liquid waste discharged to the industrial waste line contains no radioactive component. It is discharged to the industrial waste line for the convenience of the generators or because the waste will not pass the sanitary waste plant's waste acceptance criteria. The industrial waste line collects and transports laboratory wastes, process wastes, and various wastewaters. The relative sizes of the acid, caustic, and industrial waste streams are shown in Fig. 2-17.

Hazardous/Chemical Waste

Introduction

Hazardous waste is divided into three waste types: Resource Conservation and Recovery Act (RCRA) waste, Toxic Substances Control Act (TSCA) waste, and New Mexico State special solid waste. For the purposes of reporting routine waste minimization, Los Alamos National Laboratory (the Laboratory, or LANL) distinguishes between routine and nonroutine waste generation. Routine generation results from production, analytical, and/or other research and development (R&D) laboratory operations; treatment, storage, and disposal operations; and "work for others" or any other periodic and recurring work considered to be ongoing. Nonroutine waste is cleanup stabilization waste and relates mostly to the legacy from previous site operations or any other waste stream not considered to be generated on a routine basis.

The RCRA and 40 Code of Federal Regulations (CFR) 261.3, as adopted by the New Mexico Environment Department (NMED), define hazardous waste as any solid waste that:

- is not specifically excluded from the regulations as hazardous waste;
- is listed in the regulations as a hazardous waste;
- exhibits any of the defined characteristics of hazardous waste (i.e., ignitability, corrosivity, reactivity, or toxicity); or
- is a mixture of solid and hazardous wastes.

Hazardous waste also includes substances regulated under the TSCA, such as polychlorinated biphenyls (PCBs) and asbestos. Finally, a material is hazardous if it is regulated as a special waste by the State of New Mexico as required by the

New Mexico Solid Waste Act of 1990 (State of New Mexico) and defined by the most recent New Mexico Solid Waste Management Regulations, 20NMAC 9.1 (NMED), or current revisions. This determination includes the following types of solid wastes that require unique handling, transportation, or disposal to ensure protection of the environment and public health, welfare, and safety:

- treated formerly characteristic hazardous (TFCH) wastes;
- packing house and killing plant offal;
- asbestos waste;
- ash;
- infectious waste;
- sludge (except compost, which meets the provisions of 40 CFR 503);
- industrial solid waste;
- spill of a chemical substance or commercial product;
- dry chemicals that, when wetted, become characteristically hazardous; and
- petroleum-contaminated soils.

Hazardous waste commonly generated at the Laboratory includes many types of laboratory research chemicals, solvents, acids, bases, carcinogens, compressed gases, metals, and other solid waste contaminated with hazardous waste. This waste may include equipment, containers, structures, and other items that are intended for disposal and that are contaminated with hazardous waste (e.g., compressed gas cylinders). Also included are asbestos waste from the abatement program, wastes from the removal of PCB components, contaminated soils, and contaminated wastewaters that cannot be sent to the sanitary wastewater system (SWS) or high-explosives (HE) wastewater treatment plants.

Most hazardous wastes are disposed of through Duratek Federal Services, a Laboratory subcontractor. This company sends waste to permitted treatment, storage, or treatment storage disposal facilities (TSDFs); recyclers; energy recovery facilities for fuel blending or burning for British-thermal-unit recovery; or other licensed vendors (as in the case of mercury recovery). The treatment and disposal fees are charged back to the Laboratory at commercial rates specific to the treatment and disposal circumstance.

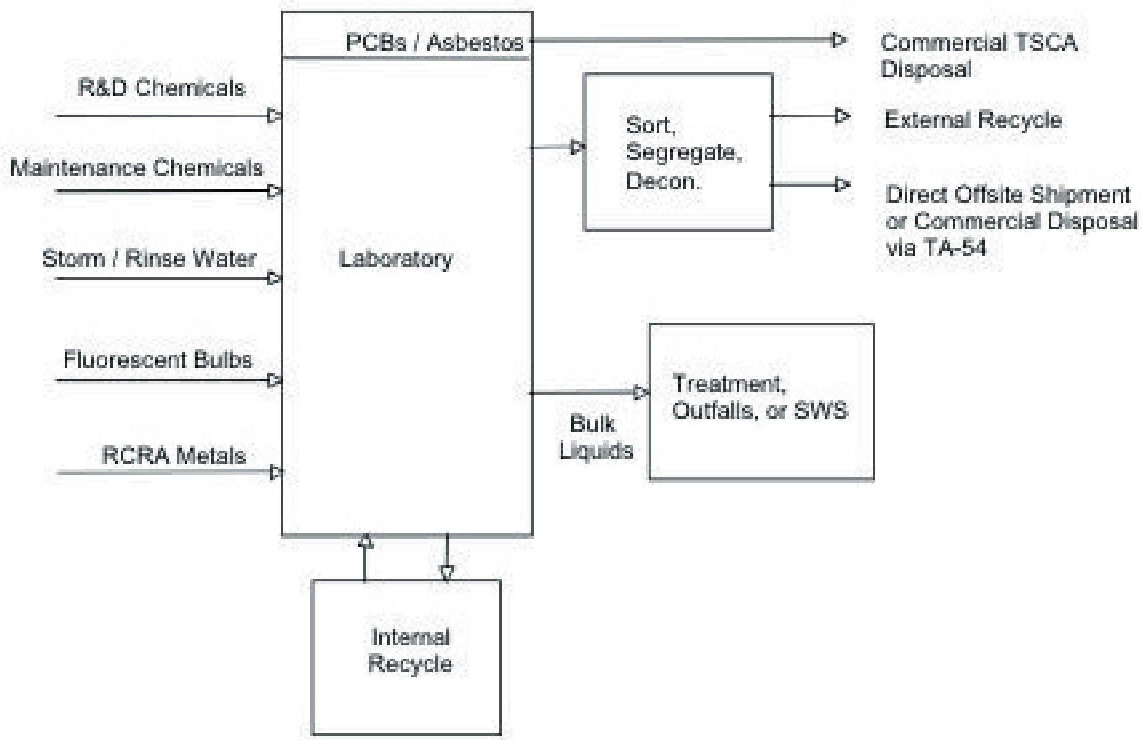


Figure 2-18. Hazardous/Chemical Process Map

The actual cost varies with the circumstances; however, the average cost for onsite waste handling by solid waste operation (SWO) and offsite disposal is $11.75/kg.

Figure 2-18 shows the process map for hazardous waste generation at the Laboratory.

Routine hazardous waste decreased sharply from FY98 because the Laboratory began excluding recycled hazardous waste from the hazardous waste total. Routine hazardous waste generation unexpectedly increased in FY01. A major factor was the disposal of hazardous wastes that had been recycled in the past. Approximately 10,250 kg of hazardous waste that could have been recycled instead was sent off site for disposal. This action resulted from a conflict between the Laboratory's performance measure for hazardous waste minimization and the waste management performance measure to process waste as quickly and cost effectively as possible. Thus, disposal was chosen over recycling. This issue has been resolved, and wastes that can will be recycled in the future.

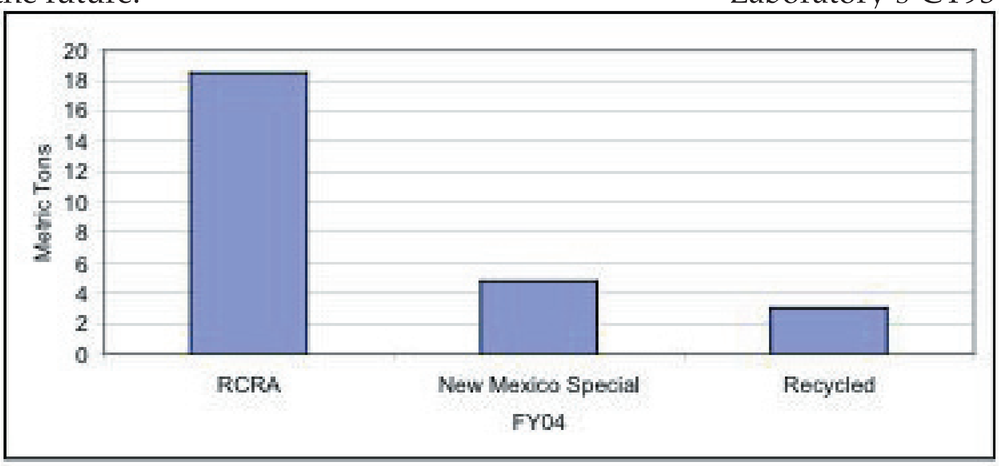


Figure 2-19. Hazardous/Chemical waste types

As previously discussed, the Laboratory produces three types of hazardous waste: RCRA waste, TSCA waste, and New Mexico special waste, also known as State waste. The quantity of routine RCRA and State waste, along with the quantity of routine recycled waste, is shown in Fig. 2-19. The waste shown in the figure excludes all nonroutine waste. TSCA waste always is considered nonroutine.

The routine hazardous waste generation by division, excluding environmental management–environmental restoration (EM-ER) waste, is shown in the pie chart in Fig. 2-20 .

The organizations that produced the most routine hazardous waste in FY04 were Engineering Science and Applications (ESA), Facilities and Waste Operations (FWO), Chemistry (C), Biosciences Division (B), and Dynamic Experimentation (DX) divisions, as well as our primary subcontractor KBR, Shaw, and Los Alamos Technical Associates (LATA) (KSL). Additional information on hazardous waste, Laboratory procedures for managing hazardous waste, and historical waste generation can be found in Refs. H-1 through H-5.

Hazardous Waste Minimization Performance

The DOE Secretarial P2E2 2005 goal is to reduce hazardous waste from routine operations by 90%, using a calendar-year (CY)93 baseline. The Laboratory's CY93 baseline quantity was 307,000 kg; therefore, the FY05 target becomes 30,700 kg.

The trend over the last several years has been very good, with the FY05 goal having been met in FY02. However, numbers trended upward in FY03. The Laboratory's performance in hazardous waste generation is shown in Fig. 2-21.

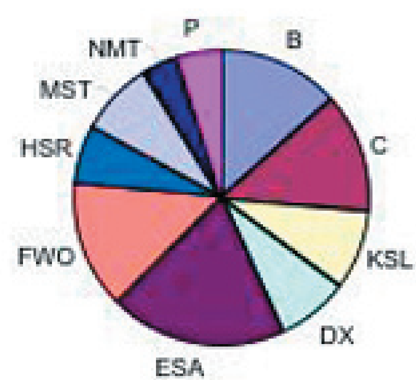


Figure 2-20. Hazardous Waste generation by division

Waste Stream Analysis

Hazardous waste is derived from hazardous materials/chemicals purchased, used, and disposed of; hazardous materials already resident at the Laboratory that are disposed of as part of

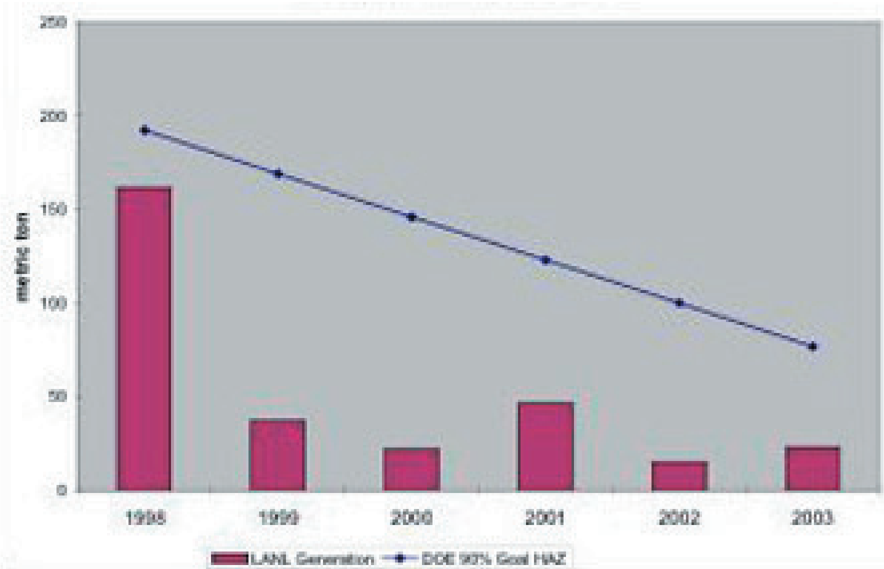


Figure 2-21. Hazardous/Chemical waste generation vs. DOE goal .

equipment replacement, facility replacement, or facility decommissioning; and water contaminated with hazardous materials.

After itis declared waste, hazardous waste is described (assayed if necessary), labeled, and collected at less-than-90-day storage areas. This waste then is either shipped directly to offsite TSDFs or transshipped to Area L, Technical Area (TA)-54, from which it subsequently will be shipped to an offsite TSDF. ER project waste typically is shipped directly from ER sites to commercial TSDFs. Spent research and production chemicals make up the largest number of hazardous waste items; however, they account for only a small fraction of the total hazardous waste volume. The ER project is the largest hazardous waste generator on site, accounting for more than 95% of all hazardous waste. The Laboratory spent a total of $1,900,000 managing newly generated hazardous waste in FY02. This is roughly equivalent to the P2 program budget for the Laboratory. The largest waste streams in the hazardous waste category for FY02 are described in the following list. These wastes are treated/disposed of off site. This list includes both routine and nonroutine wastes but excludes EM-ER wastes. The Laboratory also has HE and HE water wastes that are treated on site. Many of the largest waste streams in FY01 were reduced or eliminated in FY02 as a result of aggressive waste minimization activities. The waste streams most affected were routine oil- and petroleum-contaminated materials, ferric chloride, various contaminated liquids (routine and nonroutine), corrosives, photochemicals, ash, solvents, and mercury. Many of these previously large waste streams now contain nonroutine waste; even the routine waste has been reduced.

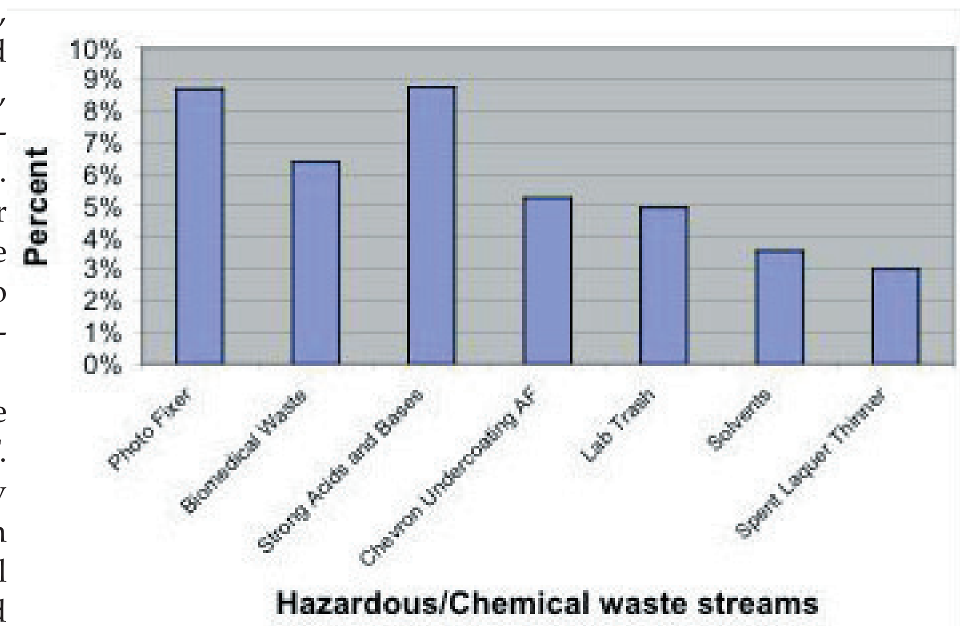


Figure 2-22. Hazardous/Chemical waste streams

The largest waste streams in the routine hazardous waste category for FY02 are shown as a percent of total hazardous waste in Fig. 2- 22. This chart

excludes RRES-RS waste, nonroutine waste, and sanitary sludge with legacy contamination. It is evident that not all of the waste is accounted for by these waste streams. About half of the hazardous waste is composed of very many small items, such as lab equipment, contaminated cans, containers, and miscellaneous chemicals.

Strong Acids and Bases A variety of strong acids and bases, such as hydrochloric and sodium hydroxide, account for approximately 10%, or 2000 kg, of the routine hazardous waste stream. Most of these are used in laboratory operations.

Biomedical Waste. This waste stream consists primarily of blood, blood-contaminated items, and used sharps. It accounts for approximately 8% of the hazardous waste stream.

Chevron Undercoating AF.

Lacquer Thinner. Lacquer thinners are used in painting operations for surface preparation and cleanup activities. Contamination from uses of the lacquer thinner, as well as losses due to evaporation, result in frequent disposal of contaminated lacquer.

Photo Fixer. Photo fixers are used in the development of photographs by several divisions at the Laboratory. The waste stream accounts for roughly 10% of the total routine hazardous waste stream.

Mineral-Oil-Soaked Rags. Mineral-oil-soaked rags are used for cleaning parts and equipment and account for ~5% of the routine hazardous waste stream.

Solvents. Solvents are used widely at the Laboratory in research, maintenance, and production operations. They constitute the single largest number of items sent for disposal each year and are persistent from year to year.

Laboratory Trash. This waste stream consists of contaminated wipes, glassware, and laboratory equipment..

REFERENCES

H-1. United States Department of Energy, "Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory," United States Department of Energy document DOE/EIS-0238 (January 1999).

H-2. United States Department of Energy, "Mitigation Action Plan for the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory," United States Department of Energy document DOE/EIS-0238 (September 1999).

H-3. "General Waste Management Laboratory Implementing Requirement (LIR)," Los Alamos National Laboratory implementation requirement LIR404-00-02.2 (issue date: November 1, 1998, revised date: October 6, 1999).

H-4. "Hazardous Waste Management LIR—Laboratory Implementation Requirements," Los Alamos National Laboratory implementation requirement LIR404-00-03.0 (effective date: December 16, 1996). 5-5. Los Alamos National Laboratory Hazardous Waste Permit NM0890010515-1 (1989).

H-5. Pollution Prevention Projects Database, available at http://emeso.lanl.gov.

H-6. Pollution Prevention Waste Database, available at http://emeso.lanl.gov

Solid Sanitary Waste

Introduction

Most material brought into Los Alamos National Laboratory (LANL, or the Laboratory) will leave as solid sanitary waste if it cannot be sold for reuse, salvage, or recycle. Sanitary waste is excess material that is neither radioactive nor hazardous and that can be disposed of in the Department of Energy (DOE)-owned, Los Alamos County-operated landfill (County landfill, or landfill) according to the waste acceptance criteria (WAC) of that landfill and the State of New Mexico Solid Waste Act andregulations. Solid sanitary waste includes paper, cardboard, office supplies and furniture, food waste, wood, brush, and construction/demolition waste. Figure 2-23 is the process map for sanitary waste generation at the Laboratory. Facility Waste Operations–Solid Waste Operations (FWO-SWO) is responsible for collecting, recycling, and managing the Laboratory's solid sanitary waste stream.

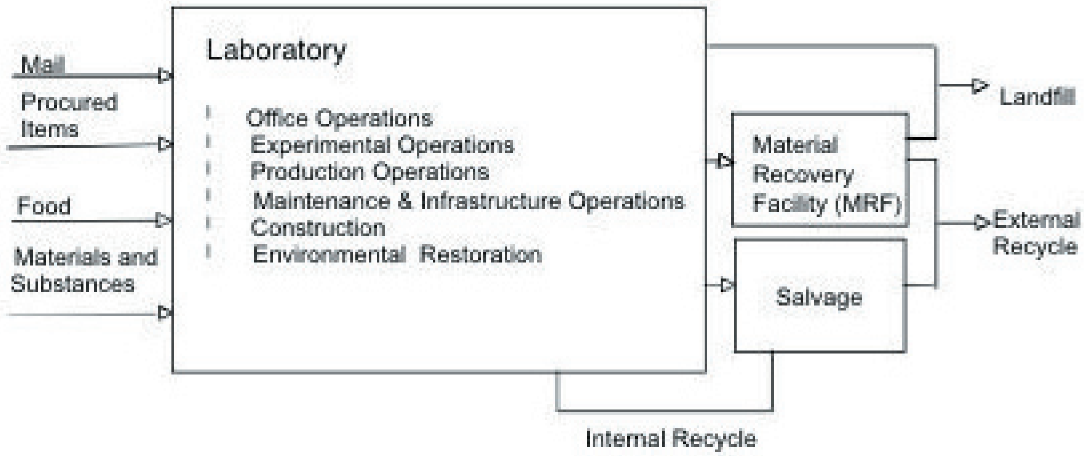


Figure 2-23. Sanitary waste process map

Materials come into the Laboratory as required by Laboratory operations. Mail includes both internally and externally generated mail. Many items, such as copiers, computers, office supplies, experimental apparatus, and furniture, are procured as part of the Laboratory's operations. Food is brought into the Laboratory as part of the cafeteria operations and from homes and restaurants. Materials and substances, such as building materials and chemicals, are used in construction, maintenance, research, and infrastructure operations.

After items either have reached the end of their useful life or are no longer needed, they are discarded. Many are salvaged or placed in recycle bins. Salvaged items can be recycled either internally or externally. Some items are discarded and end up in dumpsters. These items go to the Materials Recovery Facility (MRF), which is operated by FWO-SWO. At the MRF, items that can be recycled are segregated from the dumpster waste and sent to recycle. Items that cannot be recycled are

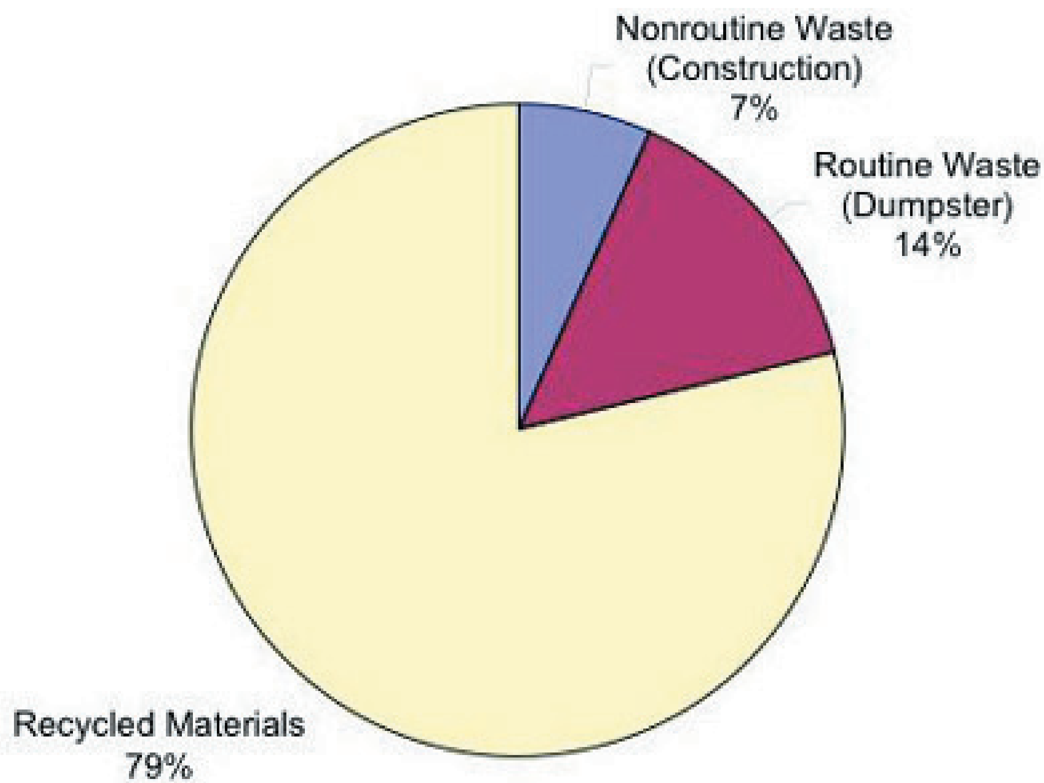


Figure 2-24. Relative volumes of sanitary waste

sent to the landfill. Some items, such as firing-site glass and nonrecyclable construction waste, go directly to the landfill. Thus, virtually every nonradioactive, nonhazardous item brought to the Laboratory eventually is either recycled or buried at the landfill. Reducing the volume of sanitary waste being buried at the landfill requires either reducing the quantity of materials flowing into the Laboratory (source reduction) or increasing the quantity of materials recycled.

The Laboratory generated 10,280 tonnes of sanitary waste in fiscal-year (FY)03. Of this total, 8100 tonnes was recycled, which comprised 5860 tonnes of nonroutine construction wastes and 2240 tonnes of routine sanitary wastes, such as paper, cardboard, metal, and wood pallets. The remaining wastes were disposed of and comprised 699 tonnes of nonroutine construction wastes and 1481 tonnes of routine sanitary waste, the vast majority of which came from Laboratory dumpsters.

Figure 2-24 displays the relative volumes of construction, routine, and recycle materials in the sanitary waste stream.

The routine sanitary waste stream has three components: dumpster waste, waste diverted from the hazardous waste stream by FWO-SWO at Technical Area (TA)-54, and other waste. The dumpster waste is composed of anything that is discarded in desk-side trashcans, trash receptacles, or dumpsters. The FWO-SWO waste is nonhazardous solid waste that is generated as process waste and is managed at TA-54.

Dumpster waste is the largest component of routine sanitary waste and includes virtually all discarded items that are not initially recycled or are not recovered at the MRF. The major constituents of the dumpster waste stream are cardboard, paper,food waste, wood, plastic, Styrofoam,glass, and metals. Figure 2-25 shows the relative weights of the components of the routine sanitary waste stream.

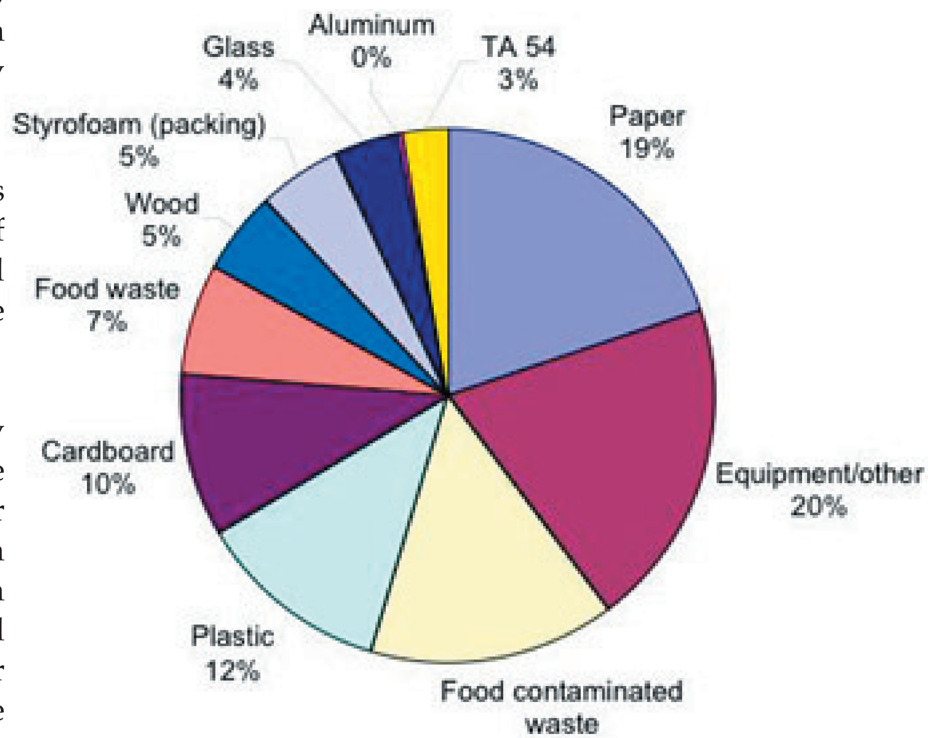


Figure 2-25. Relative weight of sanitary waste types

Sanitary Waste Minimization Performance

The DOE has implemented goals for waste minimization. The DOE proposes that solid sanitary waste generated from routine operations be reduced by 75% by 2005 and by 80% by 2010, using calendar-year (CY)93 as the baseline.

Routine waste is defined as waste generated by any type of production, analytical, and/or research and development (R&D) Laboratory operations; work for others; and any periodic and recurring or ongoing work. The Laboratory's performance toward this goal is shown in Fig 2-26. (Total yearly waste generation is calculated as the sum of

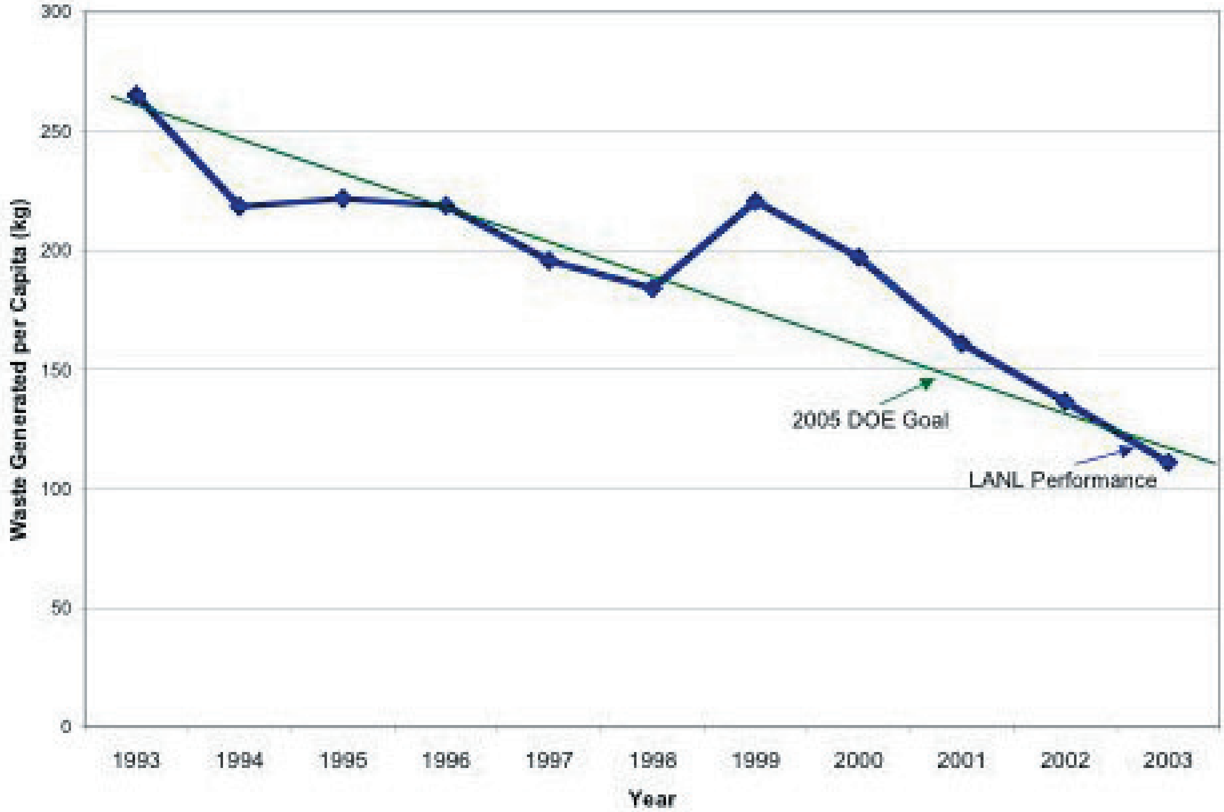


Figure 2-26. Sanitary waste generation vs. DOE goal

disposed waste and recycled volumes—only the yearly amount disposed of is represented in the graph).

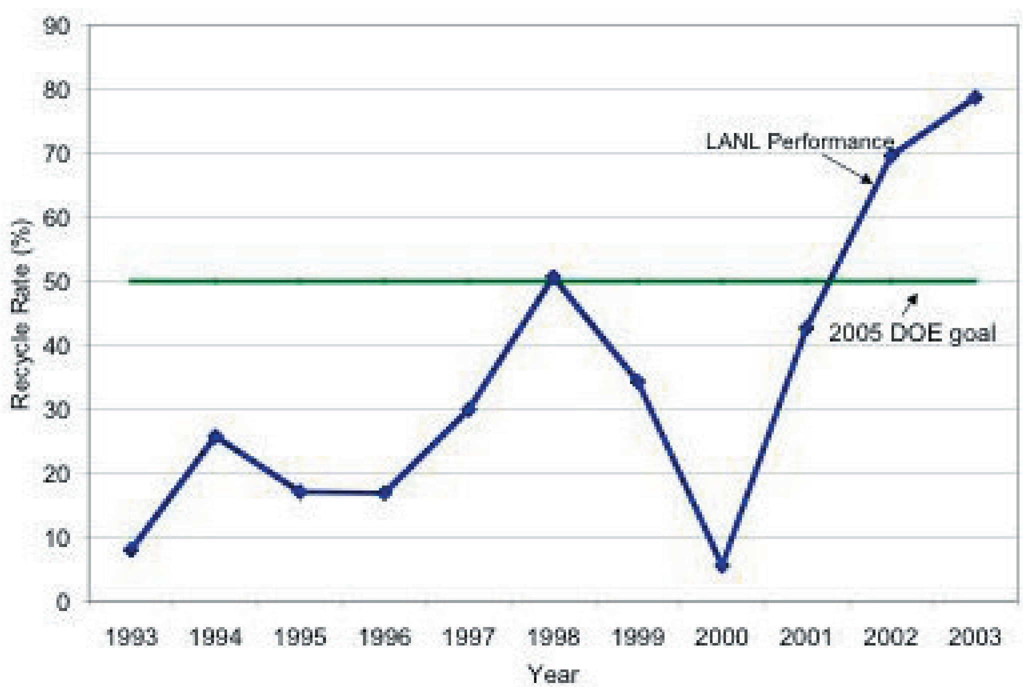


Figure 2-27. Sanitary waste recycle rate vs. DOE goal

The DOE approved a modified sanitary waste reduction goal of 55% per capita, using the 1993 baseline of 264 kg/person/year, rather than the previously mandated 75% total weight reduction by 2005. The goal was normalized to a per-capita rate to remove the waste generation effects associated with an increased mission scope since 1993. To give a better perspective, the Laboratory has doubled its budget since 1993, with a 33% increase in staffing. The revised goal is now 119 kg/person/year. The Laboratory has made good progress to date in avoiding and diverting sanitary waste since the baseline year of 1993; the per-capita waste generation rate for FY02 was 136 kg/person/year.

For FY03, the per-capita waste generation rate dropped to 111 kg/person/year, which meets the revised goal. This reduction is the outcome of aggressive waste minimization programs that include recycling of white paper, junk mail, colored office paper, catalogs, cardboard, pallets, scrap wood, and metal and source reduction efforts such as the Stop Mail program. The Laboratory also increased outreach and awareness efforts to increase the use of the recycling centers. Most major sanitary waste streams at the Laboratory have arecycling pathway.

The DOE also requires that 45% of the sanitary waste from all operations (both routine and nonroutine) be recycled by 2005 and that 50% of the waste be recycled by 2010.

As part of revising the sanitary waste generation goal, the Laboratory committed to meeting the DOE's 2010 goal by 2005. The Laboratory's performance toward this goal for recycling sanitary waste is shown in Fig. 2-27.. The recycle of total (routine + nonroutine) sanitary waste currently stands at 79%. The Laboratory has exceeded the 2010 sanitary recycle goal as demonstrated in the chart. The sharp drop in recycle rate in FY00 was due to the Cerro Grande fire. The recycle of sanitary waste was suspended for part of that year. In FY01 the Material Recovery facility (MRF) went into operation and recycle rates recovered to prefire levels. Recycle rates have improved since FY01 because of outreach and education programs, training and operational improvements at the MRF.

Waste Stream Analysis

Almost every item that enters the Laboratory (other than radioactive material, hazardous material, and materials that become radioactive) leaves the Laboratory in the sanitary waste stream at the end of its useful life. At that point, the item is recycled, reused (salvaged), or buried **F** in the landfill. Materials disposed of include construction waste, food and food-contaminated wastes, paper products, glass, and Styrofoam.

The waste stream analysis addresses wastes that were not recycled during FY03. Expanded recycling and source reduction initiatives are being instituted to reduce these waste streams further.

Nonroutine Waste Streams

Construction/Demolition Waste (699 tonnes sent for disposal). Historically, the largest sanitary waste stream at the Laboratory was the construction/demolition waste stream. The total amount of construction waste generated in FY03 decreased by 50% from FY02. Some of this waste generation decrease is related to the improved use of the Laboratory's construction waste recycle system. Another contributing factor is the overall decrease in construction activity related to the budget uncertainty associated with the continuing budget resolution in FY03. Construction/demolition waste is generated during the Laboratory's projects to build new facilities, upgrade existing facilities, or demolish facilities that are no longer needed. Construction/demolition projects require that raw materials and equipment be brought onto the site, along with utilities (especially water). The waste generated by these projects is varied and consists primarily of dirt, concrete, asphalt, some wood items, and various metal objects; the three largest components of this waste are used asphalt, concrete rubble, and dirt. This waste stream is growing and will continue to do so as planned new construction and renovation projects begin.
Recycling programs were established for concrete, asphalt, dirt, and brush in FY01. In FY03, these recycling programs diverted 3115 tonnes of concrete and asphalt, 2646 tonnes of soil, and 100 tonnes of brush. A local construction company was hired to recycle the materials as part of creating small-business economic development opportunities in Northern New Mexico.

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Routine Waste Streams

Cardboard (148 tonnes sent for disposal). Cardboard enters the Laboratory in one of two ways: as packaging materials or as newly purchased moving boxes. Some of the cardboard, particularly cardboard moving boxes, is recycled for reuse routinely. Other cardboard is discarded to either the dedicated cardboard collection roll-offs or the trash dumpsters. Dumpster trash is taken to the Materials Recycling Facility and sorted, and recyclable cardboard is recovered. Wet or food-contaminated cardboard is sent to the landfill for disposal.

Paper Products (288 tonnes sent for disposal). The Laboratory purchases ~600 tonnes of paper products each year. These products are used in a variety of ways, but mostly in offices for printing, copying, faxing, and other office support uses. Paper is used to produce unclassified, classified, and sensitive documents, and each type of document has a different path to disposal. Unclassified documents normally are disposed of in either green desk-side bins, which are taken directly to recycle or to trash bins. Approximately 150 tonnes of unclassified material is sent to storage or to archiving. This material is held in storage for varying periods before it is disposed of. Some unclassified material may be distributed to radiological control areas (RCAs), where it is subject to radioactive contamination and disposal as low-level waste (LLW). Uncontaminated paper material from RCAs may be disposed of in Green Is Clean (GIC) bins and is sent to TA-54 to be characterized and disposed of. Every year the Laboratory receives and distributes over 400 tonnes of mail. This mail includes junk and business mail, catalogs, phone directories, and various documents. The Laboratory distributes mail, including internally generated mail. Most of this material can be recycled after use.

Food and Food-Contaminated Materials (317 tonnes sent for disposal). Food products enter the Laboratory waste streams either through food service from one of the four cafeterias or from food brought into the Laboratory from off site. The total food waste stream is estimated to be ~100 tonnes/year. All of the food and food-contaminated wastes generated at the Laboratory are sent to the landfill. Currently, no composting pathways are available for food and food-contaminated wastes. However, proposed changes in the New Mexico Environment Department (NMED) solid waste regulations may encourage food composting, and other recycling pathways may become available. Food waste from trash bins and kitchen areas around the Laboratory is particularly intractable because it cannot be collected easily and contaminates other recyclable materials with which it comes into contact as a result of compaction during collection. Approximately 216 tonnes of paper, cardboard, Styrofoam, plastic, and other materials is rendered unrecyclable due to food contamination through commingling of food and other wastes in the trash.

Plastics (245 tonnes sent for disposal). Plastics and foam are used for many purposes at the Laboratory and constitute the third largest component of dumpster waste. The waste stream consists primarily of food/beverage containers, shrink-wrap, plastic bags, and packaging materials. The mixed plastics recycling program (plastic types 1–7) was discontinued in FY03 because the plasphalt recycling service provider filed for bankruptcy. No local outlets for mixed plastics recycling are available in the region. A Styrofoam recycling pilot that will be deployed fully by the end of the year was initiated in FY04. It is anticipated that 20 tonnes of Styrofoam can be diverted through this program.

Wood (72 tonnes sent for disposal). The Laboratory produces waste wood through the discarding of wooden pallets and clearing areas of vegetation. The wood contained in dumpsters also includes a significant quantity of construction wood waste that has been disposed of improperly. To the extent possible, brush and wood waste are recycled for the Laboratory by Los Alamos County. Two pallet pilot projects were initiated in FY03. In April 2003, a small-business, Northern New Mexico contractor ground up 80 tonnes of pallets. The resulting ground-up, nail-free pallet mulch was donated to the Laboratory-sanctioned Handicapped Horse Riders Association for use in the arena to improve footing. An additional 80 tonnes of pallets was sent for refurbishment to a small family-owned

Affirmative Procurement

The Federal government is the nation's single largest consumer of goods and services. The government developed five executive orders (EOs) in 1998 that collectively are known as "Greening the Government." EO 13101 is also known as "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition." This order specifically promotes the purchase of environmentally preferable products by all government organizations whenever possible. "Environmentally preferable" means that the product either contains recycled material, is recyclable, is biodegradable, or is nonhazardous. This executive order is designed to decrease the negative environmental impact of the government as much as possible. By creating this market for environmentally preferable products, more companies manufacture these products. Then environmentally preferable items become more common and more readily available to the general public as well. The process of purchasing environmentally preferable products is also known as affirmative procurement.

Los Alamos National Laboratory (LANL, or the Laboratory) began its affirmative procurement program in fiscal-year (FY)96. The Laboratory maintains an online catalog of common office products from various vendors, and any employee can use this online catalog. Products that contain recycled content are marked with the recycling logo and appear first in lists of products created by keyword searches. Products that do not contain recycled content are marked with a yield sign if a comparable product that does contain recycled material is available in the online catalog. Products marked with yield signs can be purchased only if the person ordering checks a box agreeing that the recycled content item will not work for the particular purpose intended, is significantly more expensive, or is not available in a timely manner. Over 1800 items with recycled content are currently available in the online catalog. As more products with recycled material become available, these are added to the online catalog.

The affirmative procurement history is shown in Figure 2-28 .

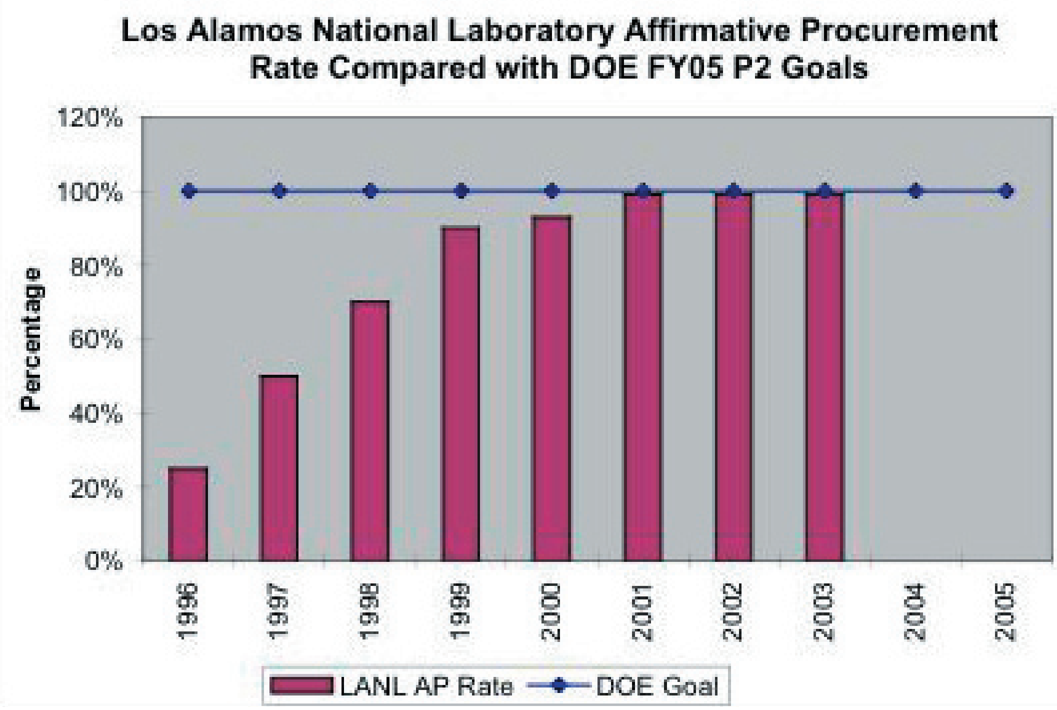

Figure 2-28. Affirmative procurement history

In FY03, the Laboratory had a 99% rate of affirmative procurement purchases from the online catalog. The Laboratory has sustained this high percentage of affirmative procurement for several years, and the ultimate goal is still 100%. Because not all purchases at the Laboratory are made through the online catalog, the Pollution Prevention (PP) Team currently is examining ways to track affirmative procurement purchases made with credit cards or purchase orders.

Energy Conservation

Introduction

The continued growth of Los Alamos National Laboratory (the Laboratory) has required and will require increased energy consumption. The addition of various facilities at the Laboratory, such as the Strategic Computing Complex (SCC) and the Dual Axis Radiographic Hydrotest (DARHT) second axis, has increased demand significantly. Access to adequate, reliable power supplies is critical to the continued growth of the Laboratory experimental and computing programs. The consumption of energy at the Laboratory clearly has reached the point where careful planning for the future will be required if growth is to be sustained. The Facility and Waste Operations Utilities and Infrastructure Group (FWO/UI) is responsible for energy planning and energy use management at the Laboratory. This group also is responsible for the Laboratory's energy conservation program.

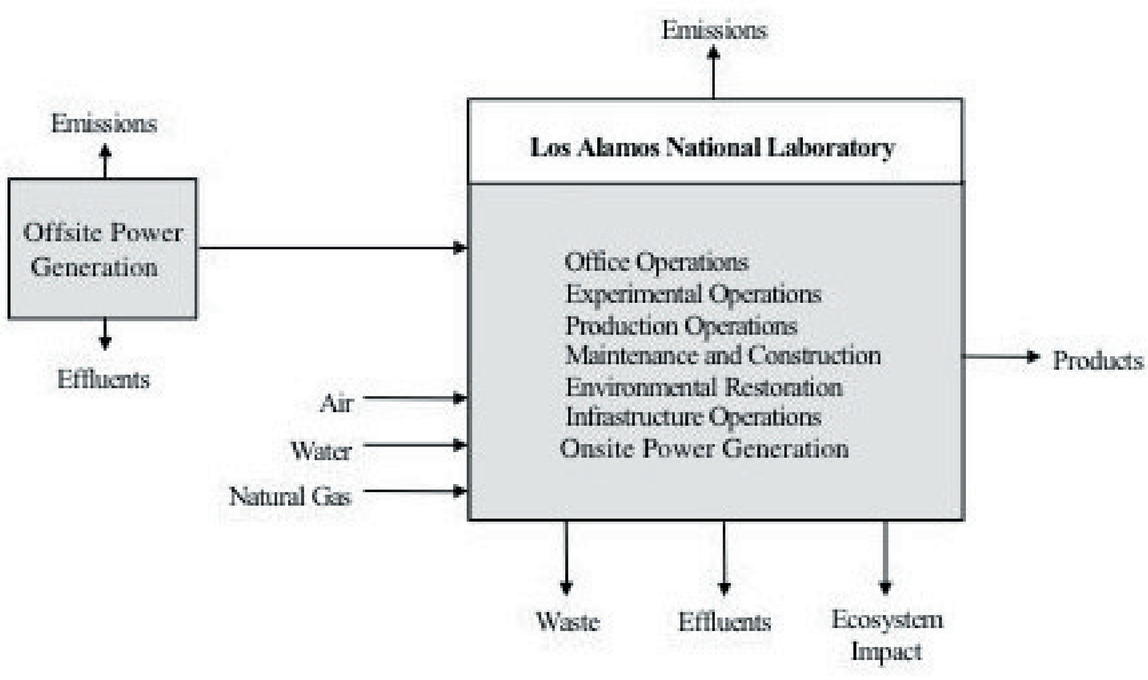

Figure 2-29 Energy process map

The current power demand challenges the existing system capacity; thus, any future growth of the Laboratory depends on finding practical and cost-effective solutions to the electrical supply and usage problems. Two avenues for improving the energy supply are conservation and increases in supply through increased power import or increased on-site generation capability. Of these two options, conservation is the easiest to implement, will have more immediate results, and will minimize the impact of energy usage on the environment; however, increasing the supply will have a much larger effect on energy availability, as well as on the environment. The Laboratory has been addressing these problems for some time and has taken significant actions, including studying options to increase the power supply and implementing Laboratory-wide conservation programs. This section investigates the trends in energy use over time, examines the constraints on such usage, defines problem areas, and explores issues and options for improved performance.

The Laboratory power supply problems are exacerbated by regional and national situations. Regionally, the northern New Mexico power grid is operating near capacity. If demand increases much beyond current levels, some load shedding may be required across the entire grid. This means that the Los Alamos Power Pool (LAPP) could be required to shed its load by curtailing electrical use and shutting down operation in one or more facilities. Nationally, the available generating capacity has not kept pace with demand, which, coupled with deregulation, has led to volatility in electrical energy costs. Costs on the open market have varied from ~$25/MWh to ~$55/MWh. If this trend persists, the cost of electrical energy could alter the strategy for ensuring future energy supplies. At the higher energy costs, a premium is placed on conservation and onsite generation. At lower energy costs, the purchase of offsite power to make up shortfalls is preferred.

The utility system (water, natural gas, and electricity supply) at the Laboratory is driven by the demand for electrical energy. As energy requirements go up, the demand for cooling water for on-site generation and the volume of effluent discharged at outfalls increase. Most of the Laboratory's consumption of electrical energy manifests itself as heat that must be removed and dissipated. In fact, ~60% of the Laboratory's water is used in cooling towers. Although the electrical supply can be increased by implementing one or more options, the critical component of the energy/water cycle (i.e., the availability of water) cannot easily be increased (see Section 7, Water Use and Conservation). The parameter most likely to limit Laboratory growth is the availability of water. Although the Laboratory currently is far from that limit, additional electrical demand brings the limit closer. Projected increased reliance on the power plant for load-following will have a pronounced effect on water use at the Laboratory. The Technical Area (TA)-3 power plant most often is used as a power-peaking facility. The facility is aging and is inefficient by modern standards; therefore, its water consumption is large relative to the energy it produces.

The system diagram for the Laboratory's consumption of energy and water is shown in Fig. 2-29.

Laboratory operation requires the consumption of water, natural gas, and electricity. Air emissions and effluent discharges result from this consumption. The use of energy and water at the Laboratory is closely coupled. Therefore, the electrical supply system at the Laboratory will be analyzed in this section.

The largest users of electrical energy at the Laboratory are shown in Table 2-4. The top four consumers account for up to 51 MW at coincidental peaks.

The peak electrical demand tends to be seasonal but nearly always is greatest when the Los Alamos Neutron Science Center Experiment (LANSCE) is operating. The monthly peak demand for the last 3 years is shown in Fig.2-30.

The peak demand is important in planning for electrical supply because the LAPP has a firm load-serving capability that is limited to 82 MW. The portion of the LAPP power supply that relies on regional hydropower is seasonal and during the winter months falls to zero. If the load demand exceeds the load-serving capability, onsite generation is required to make up the deficit. If the LAPP power supply is inadequate for the load demand, LAPP can either buy power on the open market or generate additional power on site. The limitations and options for a power supply are critical to the long-term power supply planning process and also may influence the dispatch of power on an hourly basis.

Facility	Electrical Load (MW)	Duration
LANSCE—peak	25–32	24 h/d during operation
LANSCE—base	5–7	24 h/d
Nicholas Metropolis Center (SCC)	3–5	24 h/d
Computing (CCFa and LDCCb)	4–5	24 h/d
TA-3c	10	5 d/week
TA-55	2–3.6	24 h/d

Table 2-4. Major energy consumers

The monthly consumption of electricity at the

Laboratory for the past 3 years is shown in Fig. 2-31. It is interesting to note that although the monthly peak demand has decreased from fiscal year (FY) 01, the total Laboratory electrical usage increased significantly in FY 02 and 03. The decrease in demand in FY 02 coupled with increased total usage comes from load management. In particular, LANSCE has adjusted its load so that the LANSCE peak demand is not coincident with the Laboratory's base-infrastructure peak-demand period. Shifting loads to off-peak hours has reduced the daily peak demand. The data shown in Fig. 2-31 include the LANSCE usage. The Laboratory's usage without LANSCE is shown in Fig. 2-32.

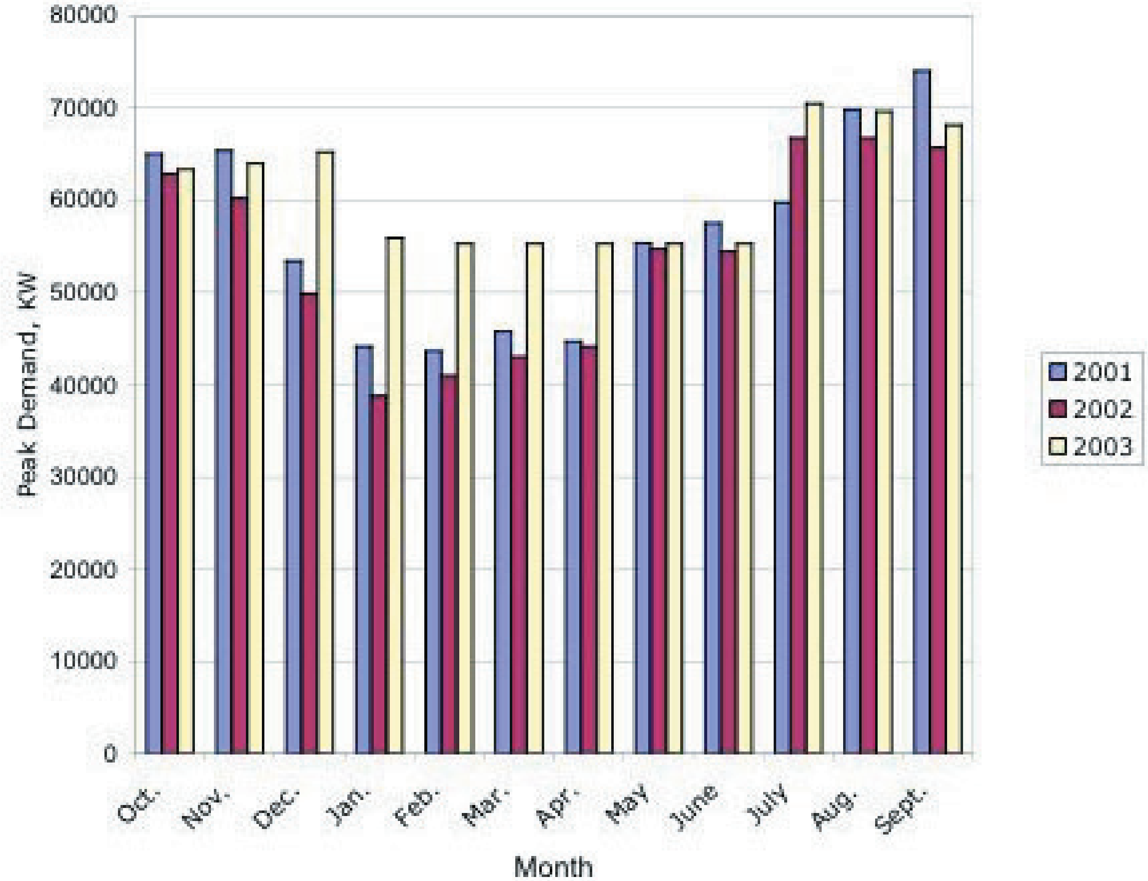

Figure 2-30. Monthly peak demand

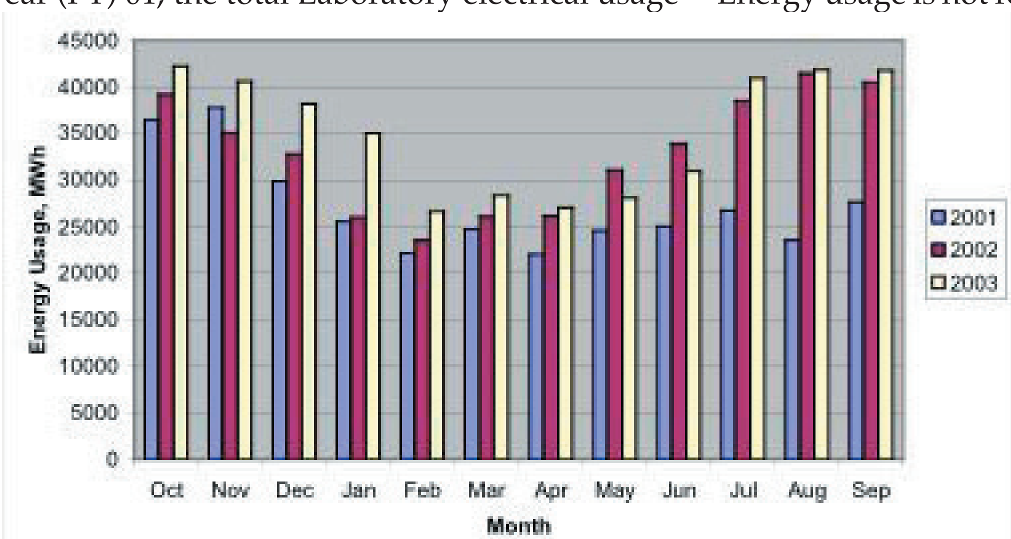

Figure 2-31. Total electrical usage

ENERGY CONSERVATION PERFORMANCE

Energy usage is not regulated, but the government has established guidelines for government facilities in the Energy Policy Act of 1992 and in Executive Order (EO) 12902, Energy Efficiency and Water Conservation at Federal Facilities (March 8, 1994). EO 12902 mandates a 30% reduction in energy use for agencies by FY05 as compared with FY85. Utility loads associated with the operations of LANSCE (defined as experimental processes) are excluded from this measure. The measure is based on a reduction in

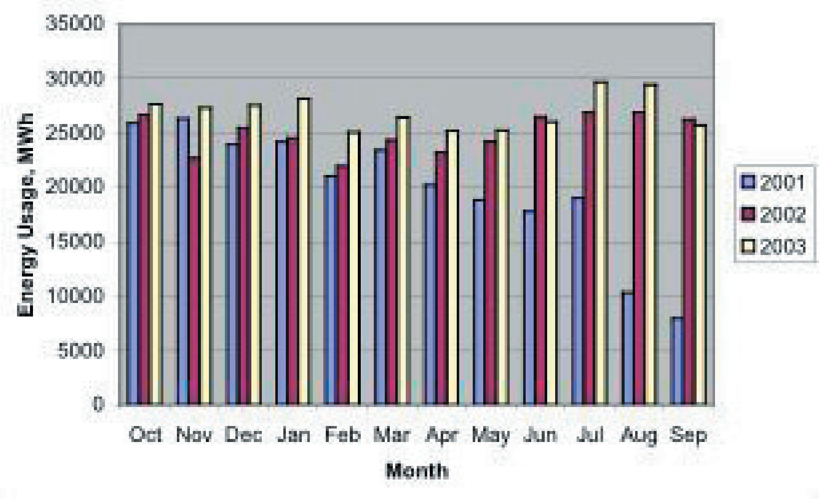

Figure 2-32. Electrical usage without LANSCE

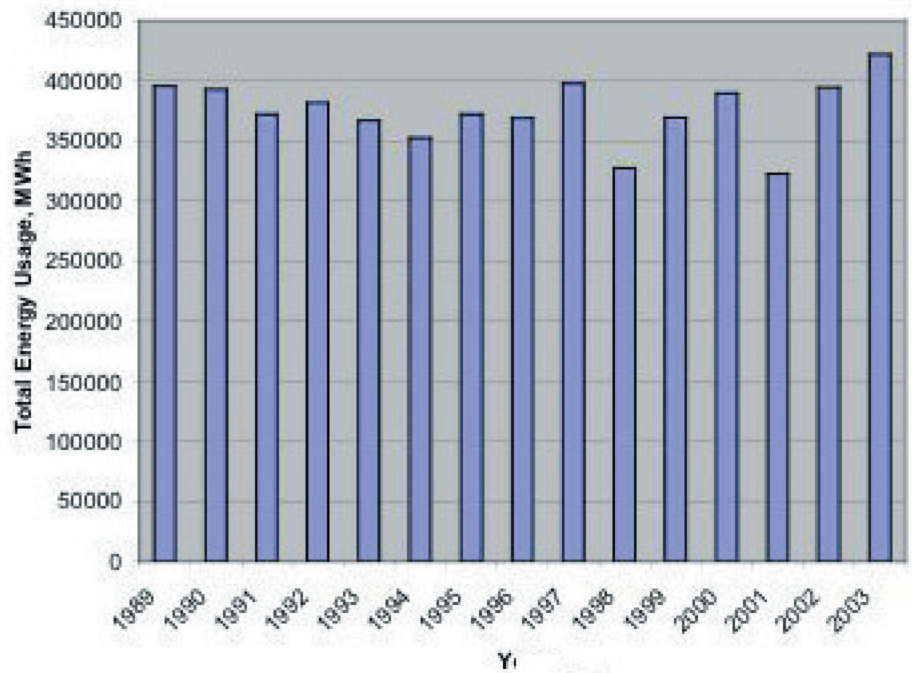

Figure 2-32. Total electrical use by year

energy usage from FY85 levels in British thermal units per gross square feet of building, expressed as a percentage of FY85 energy usage. The total energy includes electricity, natural gas, and liquefied petroleum gas.

The available data for energy consumption do not allow the reliable estimation of consumption by division or by user other than the largest users, nor does the performance measure require it. Therefore, there is no detailed breakdown of consumption for energy. Laboratory electrical consumption, by year, is shown by year in Fig. 2-33

The Laboratory's use of natural gas is limited and tends to be seasonal. The principal use of natural gas is for space heating, although natural gas is burned by the power plant. Natural gas usage is shown for the last two FYs in Fig. 2-34.

Usage Analysis

The impact of the electricity usage by the Laboratory is at least regional and arguably global. Regional coal and water resources are affected by the necessity to generate power for the Laboratory, and emissions from this generation of power, which although are small in an absolute sense, nevertheless contribute to pollution of the global atmosphere. The Laboratory cannot function with a significant reduction in electrical usage; in fact, the

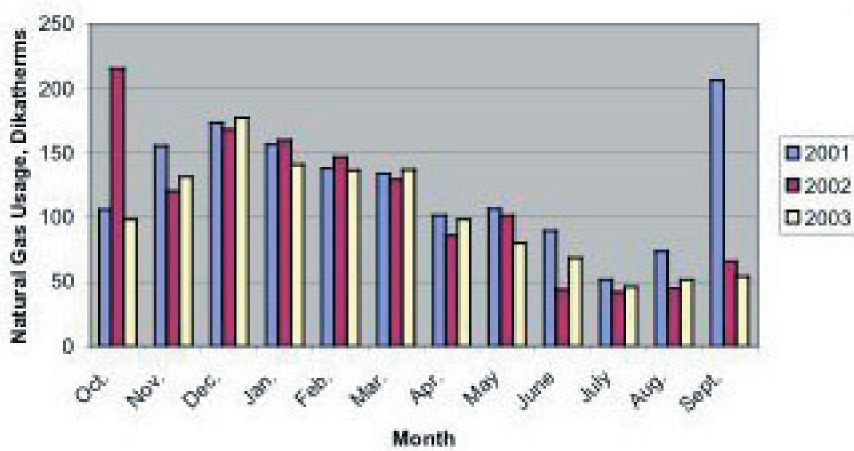

Figure 2-34 Natural gas usage

Laboratory will require more electrical power in the future. The increased usage of power directly impacts not only the waste streams associated with power generation, but also water consumption and wastewater discharge. Usage of electricity is a complex system at the Laboratory and is strongly coupled to the consumption of water and emission of pollutants.

Electricity is imported into the Laboratory from offsite sources; however, because peak coincidental demand can exceed the import capacity, it sometimes is necessary to generate power at TA-3 by burning fuel oil or natural gas. Natural gas also is burned to produce steam and hot water for space heating and process support.

The waste streams associated with use of energy at the Laboratory are emissions in the form of industrial gases and wastewater effluent from various cooling towers. Emissions occur on site when the TA-3 power plant is operating and as the result of Laboratory consumption of electricity imported from off site. Emergency power generation and portable generators also produce emissions.

With the exception of water usage in conjunction with onsite generation, the sizes of the waste streams associated with Laboratory electrical usage are not known.

Water Conservation

Introduction

The utility system (water, natural gas, and electrical supply) at Los Alamos National Laboratory is driven by the demand for electrical energy and by the increasing Laboratory population. As energy requirements increase, the demand for cooling water and the volume of effluent discharged at outfalls increase. Most of the Laboratory's consumption of electrical energy manifests itself as heat that must be removed and dissipated. In fact, ~60% of the Laboratory's water is used in cooling towers. Although the electrical supply can be increased by implementing one or more options, the critical component of the energy/water cycle (i.e., the availability of water) cannot be increased easily.

The Laboratory is targeted to use no more than 30% of the total Los Alamos County water rights, or 542 million gallons per year. Water demand at the Laboratory is projected to grow as a result of new mission requirements. With water conservation projects now being implemented, the Laboratory has sufficient water resources to operate current and planned facilities. If the Laboratory significantly increases operation of present facilities or constructs additional ones, its historical water usage could be exceeded. Although Los Alamos County, which supplies water to the Laboratory, has unused water rights, a significant increase in Laboratory or County water use could exceed current water resources. Consequently, it is in the Laboratory's and the County's best interests to pursue an aggressive, cost-effective, water-conservation and gray-water-reuse program. It is also in their joint interest to develop additional water resources to accommodate future growth. Water use and planning at the Laboratory is the responsibility of the Facilities and Waste Operations Division (FWO/UI), Utilities and Infrastructure group. This group tracks water use and manages improvements and repairs to the infrastructure that reduce water use at the Laboratory. The newly formed Water Conservation Committee, chaired through FWO Waste Facilities Management (WFM), will represent the Laboratory on all water conservation issues and will interact on the Laboratory/University of California (UC) institution, Los Alamos County, the Department of Energy (DOE), and regional, state, and national levels. The Water Conservation Committee provides leadership in two areas. The first is in direction, integration, and coordination to promote responsible stewardship in regard to activities potentially affecting regional water resources. Such activities may include, but are not limited to, understanding the legal bases of Los Alamos County and DOE water rights; reviewing water availability issues related to future DOE and

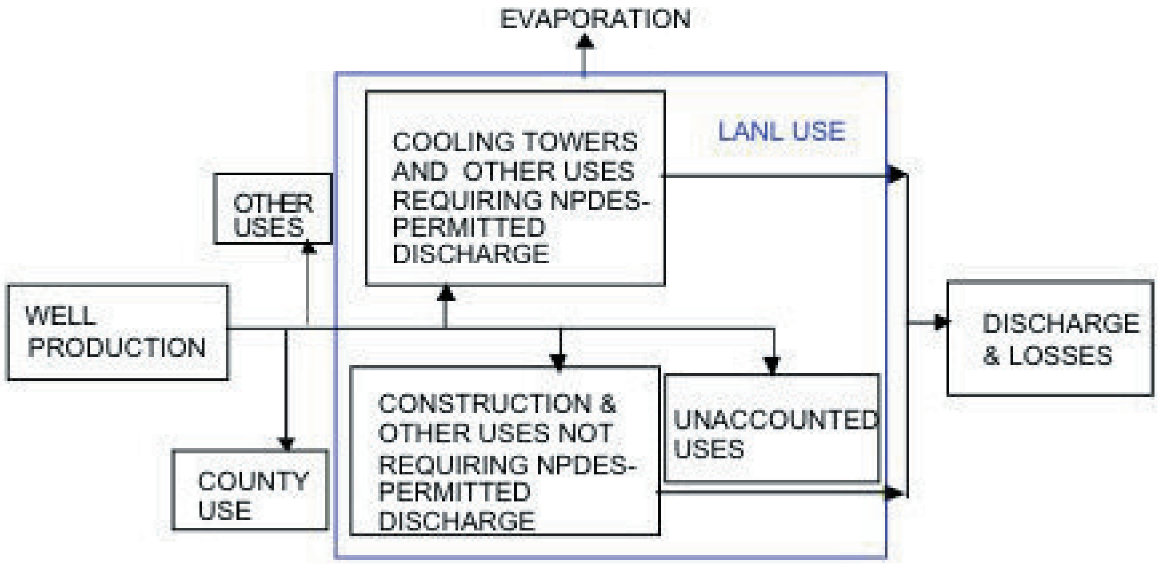

Figure 2-35. Water system process map

The second area of responsibility is the tracking of and participation in regional water planning initiatives outside of Los Alamos County that may affect water availability and/or use.

Los Alamos County plans; compiling and maintaining an accurate yearly record of actual water use; developing water use forecasts; anticipating and promoting local, state, and federal water conservation goals and practices; and recommending water conservation technologies.

The Laboratory used ~432 million gallons of water in fiscal-year (FY)00, 348 million gallons in FY01, 337 million gallons in FY02, and 355 million gallons in FY03. The source of this water is a series of deep wells that draws water from the Rio Grande aquifer. Approximately 60% of Laboratory water flows into cooling towers. Without the cooling-tower-water efficiency upgrades, this flow may increase by as much as 70% by 2005 because of new facilities that are being built. Approximately half of this water evaporates; the remainder is released into the Laboratory sanitary system or surrounding canyons through National-Pollutant-Discharge-Elimination-System (NPDES)-permitted outfalls and ground-water (GW) permits. Water is consumed at the Laboratory for many purposes, including cooling-tower uses, operations, domestic use, landscaping, and temperature control. The water eventually is discharged in the form of sanitary water effluent, outfalls, evaporation, or leakage losses. The water supply system and water balance for the Laboratory are shown in Fig. 2-35.

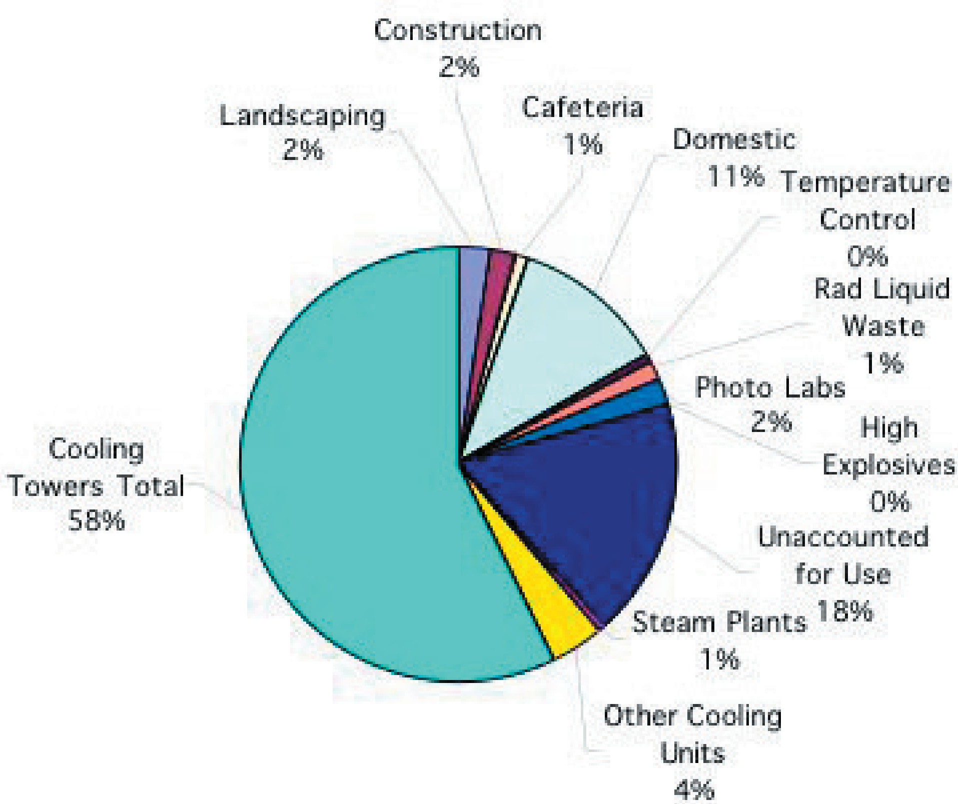

Figure 2-36 Water use at the Laboratory

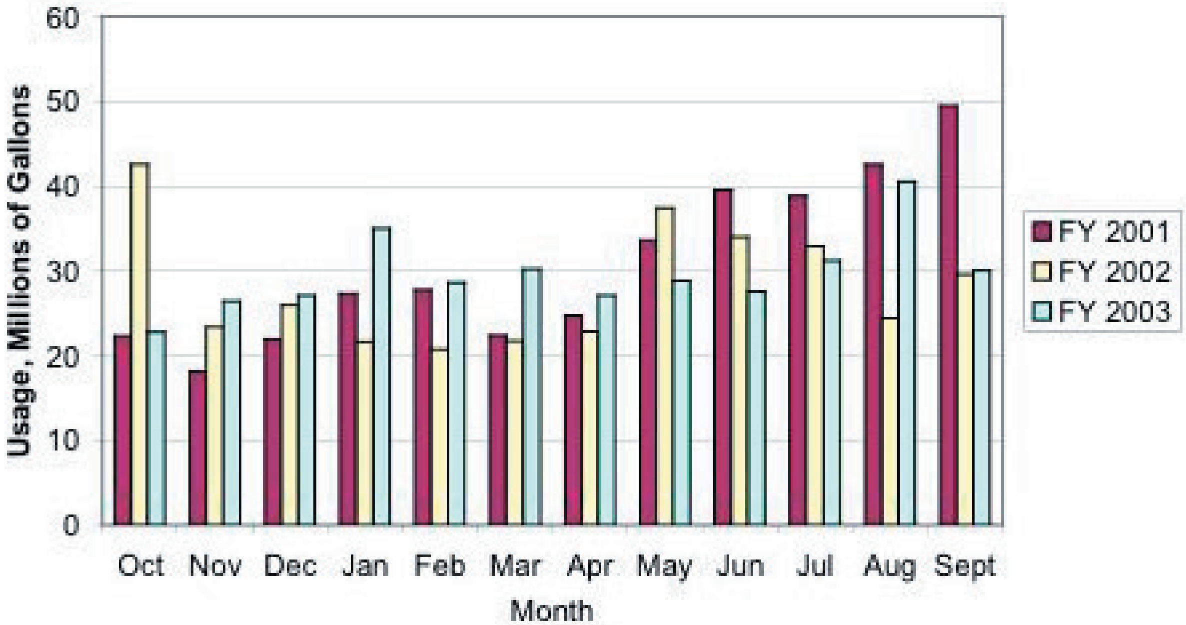

Figure 2-37. Water usage by month

The Laboratory's largest water discharge is to the environment. These discharges are regulated through NPDES, GW, and/or storm water permits. The various discharges are listed below:

- Water from cooling towers is discharged directly to NPEDS/GW-permitted outfalls or is sent to the Laboratory sanitary system.

- Water used for industrial and domestic purposes is discharged to the Laboratory's sanitary system if it meets the waste acceptance criteria (WAC).

- Treated sanitary wastewater is discharged either directly to NPDES/GW-permitted outfalls or to cooling towers for reuse.

- Water used in construction processes is discharged to the environment and is regulated by a storm-water permit.

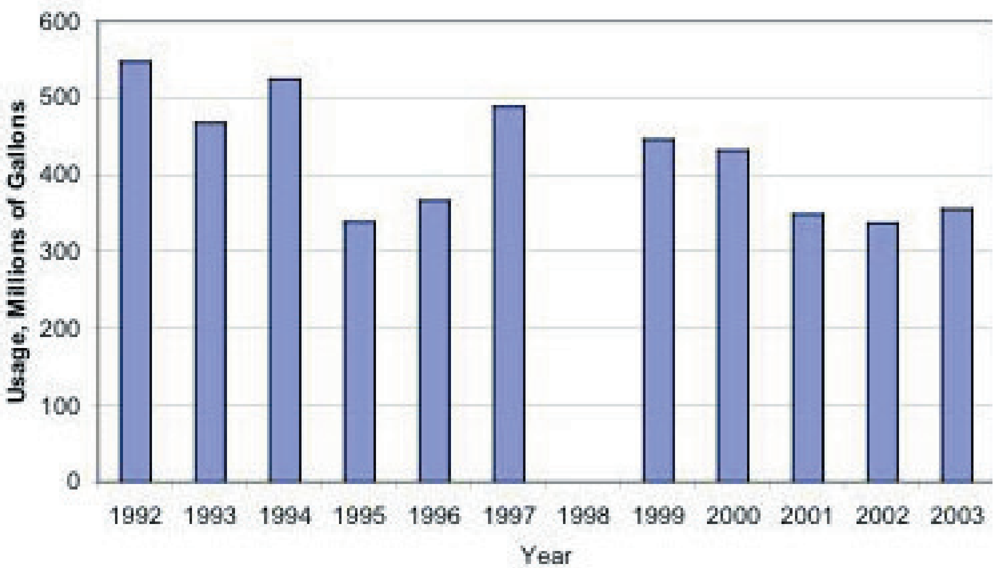

Figure 2-38. Water usage by year

The only unregulated discharges of water to the environment are leaks and potable water used for landscaping.

The estimated consumption of water by use type at the Laboratory is shown in Fig. 2-36. This distribution of water use is only approximate and is based on a 1997 estimate. By far, the largest use of water at the Laboratory is cooling. The various cooling towers that operate at the Laboratory consume 58% of the total water usage. The largest cooling towers, by volume of water consumed, are the Los Alamos Neutron Science Center (LANSCE) towers at Technical Area (TA)-53 and the TA-3 towers associated with the large computer facilities [the Central Computing Facility (CCF), the Laboratory Data Communications Center (LDCC), the Nicholas Metropolis Center, and the TA-3 Power Plant]. The major constraint on the cooling-towers' water efficiency is silica concentrations in the cooling water. The concentration of silica in the local GW is ~88 ppm. Because silica will begin to precipitate out and foul heat-exchanger surfaces at ~200 ppm, the concentration must be controlled below that level. Currently, the silica concentration is controlled by operating the towers at 1.5 to 2.0 cycles of concentration. However, the Laboratory is addressing this problem and will deploy water treatment technologies that will allow cooling-tower operation at higher cycles of concentration.

The overall consumption of water at the Laboratory in FY01, FY02, and FY03 is shown by month in Fig. 2-37. The trend in water consumption is somewhat seasonal, with the largest volumes being consumed in the summer. Because this is the period of hottest weather and therefore frequently has the highest electrical demand, water usage at the Laboratory correlates to electrical demand. Because LANSCE is the largest single consumer of electrical energy on site, water use is dependent on the LANSCE run cycle.

Over the past few years, LANSCE run cycles have been shortened by comparison with previous years. Thus, a strong correlation between LANSCE-run energy consumption and overall water consumption is not immediately evident. However, when LANSCE resumes a full 7- to 9-month operation cycle, the effect on water consumption will be more pronounced.

Water Conservation Performance

The Laboratory has not established water conservation performance goals. However, Executive Order (EO) 13123, "Greening the Government through Energy Efficiency Management," mandates the development of such water goals. In advance of these goals, the Laboratory has committed to an aggressive water conservation program. The consumption of water at the Laboratory (by year) for recent years is shown in Fig. 2-38.

The data for years before 1999 are approximate because of many factors, including incomplete metering at the Laboratory, unknown system losses, and uncertainty in distribution. There are no reliable data for FY98 because in that year, operation of the Los Alamos water supply and distribution system was transferred from the DOE to Los Alamos County. The different techniques for measuring and estimating water used at these two entities lead to greater-than-normal uncertainty in the estimate of water use. No strong trend in water use can be found at the Laboratory. A pronounced reduction occurred in the mid-1990s, but consumption then rose again. Consumption has decreased over the last 3 years, in part because of an aggressive leak-repair program and attention to cooling-tower operations. LANSCE has installed new cooling towers and improved the cooling-tower control systems. These projects at LANSCE have reduced water consumption by several million gallons per year. The Nicholas Metropolis Center has been upgraded to modern, efficient cooling-tower

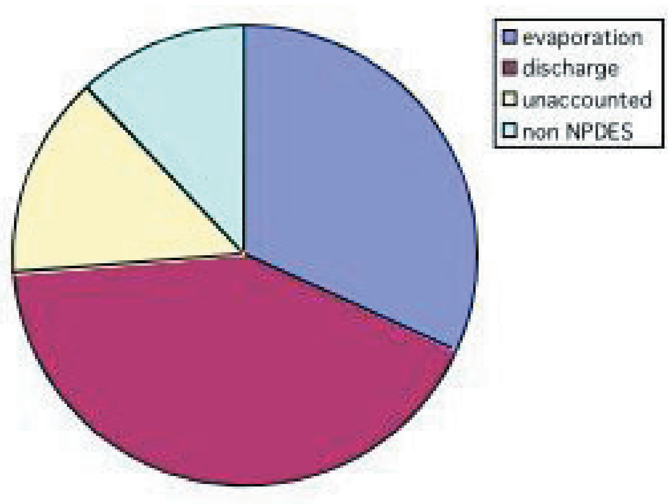

Figure 2-39. Water loss and discharge pathways

control systems and is using Sanitary Wastewater System (SWS) water. Improved cooling-tower control systems have been installed at TA-35. The effect of these improvements has been to lower water consumption at the Laboratory markedly.

Construction is underway on the Cooling-Tower Water Conservation (CTWC) Project and the

TA-48 cooling-tower control systems upgrade. When these projects are finished, the Laboratory's consumption of water will be reduced a further 40 million gallons per year.

Waste Stream Analysis

Consumptive use of water leads to evaporation or discharge following use. At the Laboratory, NPDES and GW permits control most discharges of wastewater. Of all the water that comes onto the site, approximately half evaporates. That which does not evaporate eventually is discharged. Of the discharged water, 88% is regulated by NPDES/ GW permits. The remaining 12% of discharges is not regulated. Figure 2-39 shows the distribution of water discharge and loss at the Laboratory.

The following wastewater streams are associated with water use at the Laboratory.

- Evaporation—Many water uses at the Laboratory involve some evaporation. Some uses, such as cooling towers, involve large losses through evaporation.
- NPDES-Regulated Discharges—These discharges originate from cooling towers, cafeterias, domestic use, research activities, laboratories, steam plants, etc. Much of this water is treated before discharge, either within the SWS plant or in a specialized treatment plant such as the High Explosives Wastewater Treatment Plant.
- Non-NPDES-Regulated Discharges—These discharges occur through those activities exempted from the NPDES. They include discharges from landscaping and construction.
- Unaccounted Use—This waste stream consists of water that is drawn from the water supply but that either does not enter a Laboratory-consumptive-use process or is not accounted for in that use. The quantity of water drawn from wells is reasonably well known, and the water use at the Laboratory can be estimated. Usually, ~10% to 15% of the water drawn from the water supply cannot be accounted for. The sources of this apparent loss could be inaccuracies in the use estimates, leaks in the distribution system, or a combination of these and other uncertainties. With the current metering system, we find that it is not possible to estimate the size of this stream reliably or to find the source of the losses.

Sustainable Design

Sustainable design may be defined as activities to "site, design, deconstruct, construct, renovate, operate, and maintain state buildings that are models of energy, water, and materials efficiency; while providing healthy, productive and comfortable indoor environments and long-term benefits

Design decisions dictate environmental and productivity impacts of infrastructures for decades. Implementation of sustainable design practices in all construction will support the following Los Alamos National Laboratory (the Laboratory, or LANL) institutional and business goals.

- Build the agile workforce for the future.
- Modernize and consolidate facilities/ infrastructure to support safe, secure, and efficient Laboratory operations.
- Institute an integrated corporate approach to plan, allocate, and manage Laboratory resources to maximize the accomplishment of the LANL mission.
- Employ those business practices that best serve our trusted, competitive, scientific solutions.
- Improve the efficiency with which we achieve regulatory compliance and manage the risk to support operational excellence.

The past decade has seen stunning technical advances in designing and constructing buildings to maximize the performance of their occupants while minimizing resource consumption and environmental impact. Such advances have achieved significant life-cycle savings without necessarily increasing up-front construction costs. The key Laboratory benefits from incorporating sustainable design practices are the following.

- minimizes environmental impacts;
- protects workers;
- improves mission capabilities;
- decreases mission vulnerabilities;
- creates a positive work environment for the workers (e.g., daylighting);
- provides flexibility to address the ever-changing regulatory requirements;
- increases staff productivity;
- optimizes efficiency of entire buildings;
- improves the Laboratory's public image; and
- reduces waste management costs.

During the past few years, both the Department of Energy (DOE) and the University of California (UC) have been reviewing and implementing requirements for sustainable design in new and refurbished buildings.

On January 15, 2003, the DOE implemented Order 450.1 for an Environmental Protection Program, which requires contractors to implement various EOs, such as EO 13123, "Greening the Government through Efficient Energy Management," conduct operational assessments for pollution prevention (PP) opportunities, and procure environmentally preferable products.

In July of 2003, the UC Board of Regents adopted a policy for green buildings and clean energy standards. The UC will be required to create an internal certification process based on the Leadership in Energy and Environmental Design (LEED™) standard, which evaluates the environmental sustainability of buildings. Significant renovations of existing buildings also will be required to apply sustainability principles. The UC also will develop a strategic plan for implementing energy efficiency projects for existing buildings and infrastructure to reduce systemwide nonrenewable energy consumption, with an initial goal of reducing energy consumption by 10% or more by 2014.

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Chapter 3: Remediation Services Pollution Prevention Awareness Plan

Background

Waste minimization is an inherent goal in all operating procedures of Los Alamos National Laboratory (the Laboratory). The United States (US) Department of Energy (DOE) and the Laboratory are required to submit a waste minimization plan annually to the New Mexico Environment Department (NMED) in accordance with the Laboratory's Hazardous Waste Facility Permit. This document represents the waste minimization and pollution prevention (WMin/PP) awareness plan for the Laboratory's Risk Reduction and Environmental Stewardship Remediation Services (RRES-RS) Project.

This plan supports the RRES-RS Project's WMin/PP goals and describes its plan to incorporate waste reduction practices into RRES-RS activities and procedures. The plan was prepared by the RRES-RS Project Office, formerly the Environmental Restoration Project, pursuant to the requirements of Module VIII, Section B.1 of the Laboratory's Hazardous Waste Facility Permit (NM0890010515-1).

The mission of the Laboratory's RRES-RS Project is to investigate and remediate potential release sites as necessary to protect human health and the environment. In completing this mission, RRES-RS activities may generate large volumes of waste, some of which may require special handling, treatment, storage, and disposal. Because the RRES-RS Project is tasked with investigating and conducting corrective action, as necessary, at historically contaminated sites within the Laboratory, source reduction and material substitution are difficult to implement. However, the conduct of site cleanups generates waste and thus the RRES-RS Project is faced with the responsibility and challenge of minimizing the amounts of waste that will require subsequent management or disposal. Minimization is necessary because of the high cost of waste management; the limited capacity for on site or off site waste treatment, storage, or disposal; and the desire to minimize the associated liability.

In 1990, Congress passed the Pollution Prevention Act, which changed the focus of environmental policy from "end-of-pipe" regulation to encouraging source reduction or minimizing waste generation. Under the provisions of the Pollution Prevention Act and other institutional requirements for treatment, storage, and disposal of wastes, all waste generators must certify that they have a waste minimization program in place. The elements of this program are defined further in the May 1993 US Environmental Protection Agency (EPA) interim final guidance, 58 F.R. 102, "Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program." The program guidance lists what the EPA considers to be the minimum level of infrastructure and effort that must be expended to have an acceptable program. This guidance requires top management support, process evaluation, technology exchange, waste minimization employee training, and waste generation tracking and projections.

The DOE Office of the Secretary also requires that a pollution prevention program be in place, as outlined in the 1996 Pollution Prevention Program Plan (DOE/S-0118). The DOE plan has specific program requirements for every waste generator, including evaluating waste minimization options as early in the planning process as possible. The DOE plan also places all responsibility for WMin/PP implementation with the waste generating program. In a November 12, 1999, memorandum, the Secretary of Energy set an annual 10% reduction goal for all wastes generated from facility decommissioning and site stabilization activities The Laboratory's approach to achieving the 10% reduction goal is addressed later in this document.

Purpose and Scope

The purpose of this plan is to document the RRES-RS Project's approach that minimizes waste generation. This plan discusses the goals, methods, and activities that will be employed routinely to prevent or reduce waste generation in fiscal year 2004 (FY04), and it reports FY03 waste generation quantities and significant waste minimization accomplishments for FY03. This plan also discusses the RRES-RS deputy project director's commitment to WMin/PP, provides a discussion of specific program elements of the RRES-RS WMin/PP Program, and presents the barriers to implementation of further significant reductions.

This plan is designed to fulfill the waste minimization requirements of the Resource Conservation and Recovery Act (RCRA)/

Hazardous and Solid Waste Amendments, as implemented in Module VIII, Section B.1, of the Laboratory's Hazardous Waste Facility Permit.

were used in the investigative or remedial process and may include waste derived from exploratory activities (e.g., personal protective equipment, sampling waste, and drill cuttings); treatment residues; wastes resulting from storage or handling operations; and additives used to stabilize waste. The RRES-RS Project may generate the following waste types: radioactive low-level waste (LLW); mixed low-level waste (MLLW); transuranic radioactive waste; chemical wastes [which include RCRA hazardous wastes, Toxic Substances Control Act (TSCA) wastes, and New Mexico Special wastes]; and/or solid waste.

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Table 3-1. Los Alamos National Laboratory Hazardous Waste Facility Permit, Module VIII, Section B.1

This plan addresses all waste classifications generated by the RRES-RS Project during the course of planning and conducting the investigation and remediation of environmental media funded by the DOE Office of Environmental Management (DOE/EM). Wastes generated by RRES-RS include "primary" and "secondary" waste streams. Primary waste consists of generated contaminated material or environmental media that were present as a result of past DOE activities, before any containment and restoration activities. The waste includes contaminated building debris or soil from exploratory and remedial activities. Secondary waste streams consist of materials that

The scope of a WMin/PP effort for an individual RRES-RS project will depend on the primary and secondary wastes anticipated to be generated and the feasibility of waste reduction for those waste streams.

Requirements of the Operating Permit

Module VIII, Section B.1 of the Laboratory's Hazardous Waste Facility Permit requires that a waste minimization program be in place and that a certified plan be submitted annually to the administrative authority. The specific requirements of the permit are listed in Table 3-2, along with the corresponding section of the plan that addresses the requirement.

RRES-RS Deputy Project Director Policy Statement And Management Commitment

The Laboratory's support for pollution prevention and waste minimization programs is documented in the Laboratory waste management requirements. The RRES-RS Project additionally mandates waste minimization techniques in several of its standard operating procedures. In addition, the RRES Division Pollution Prevention Program (RRES-PP)

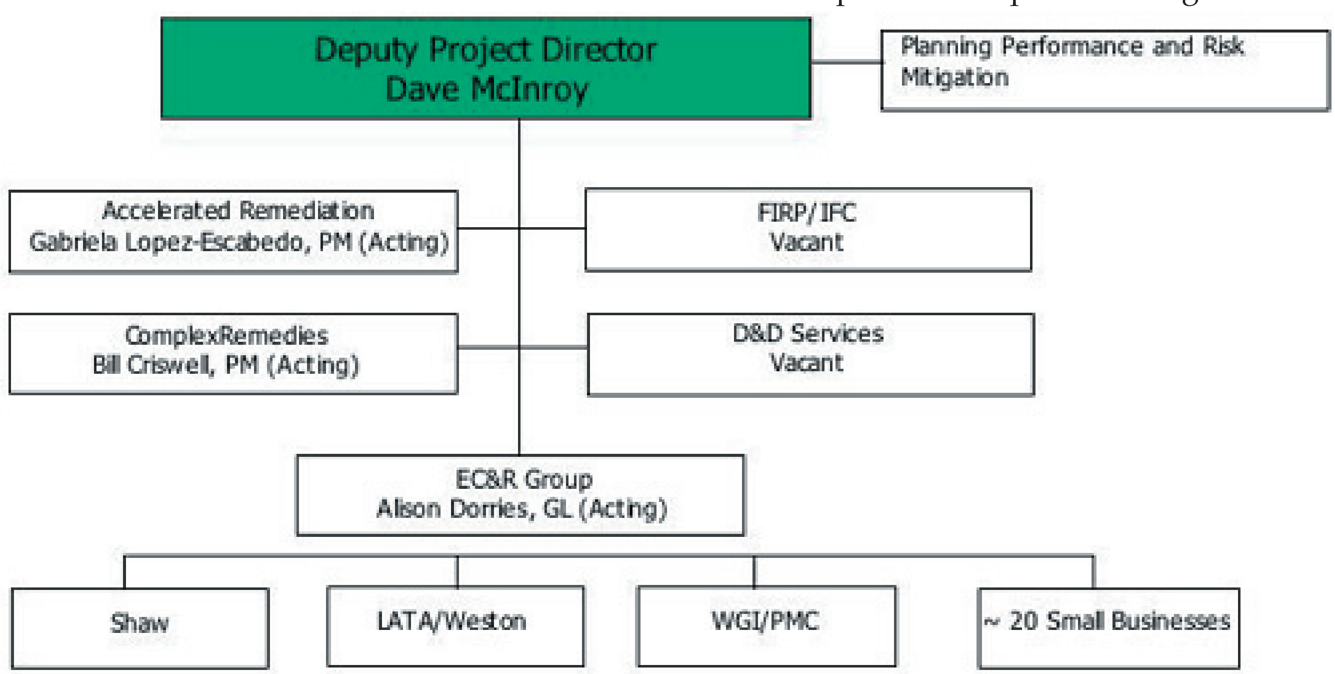

Figure 3-1. Remediation Services Organization

is tasked by DOE and the Laboratory to champion and implement an aggressive waste minimization and environmental stewardship program for the entire Laboratory.

Another management program in place at the Laboratory is the Environment, Safety, and Health Identification (ESH-ID) process, which is a tool designed to assist Laboratory personnel in identifying, managing, and complying with Environment, Safety, and Health Laboratory implementation requirements, which may impact project planning and execution. This process incorporates the evaluation of potential waste-generating activities before project startup and includes review by a waste minimization/ pollution prevention subject-matter expert.

The RRES-RS Project fully supports the Laboratory's and RRES Division's written WMin/PP policies, programs, and commitments. The RRES-RS Project will support the goal of waste reduction by giving preference to source reduction, improved segregation and characterization, and environmentally sound recycling practices regarding waste treatment and disposal techniques to the degree determined to be economically practicable. Evidence of the RRES-RS Project commitment is demonstrated by this plan, as well as by the documentation of past waste reduction efforts within the RRES-RS Project (Section 5.4). The RRES-RS Project will allocate sufficient resources to pursue the goals and approaches established by this plan and will coordinate with the RRES-PP Program as necessary.

Organizational Structure And Staff Responsibilities

The RRES-RS Project is part of the RRES Division at the Laboratory and is subject to all Laboratory and RRES Division policies and requirements. The organization of RRES-RS is shown in Figure 3-1. The organizational structure for developing and implementing WMin/PP programs is outlined as follows.

- The Laboratory director and the deputy director for operations have oversight responsibilities and provide annual review of the Laboratory-wide WMin/PP Program goals and performance.

- The RRES Division has primary responsibility for the Laboratory-wide WMin/PP Program, including the RRES-RS Project.

- The RRES-PP Program has been tasked by the RRES Division to develop and manage the Laboratory-wide WMin/PP and environmental stewardship programs. The RRES-PP Program provides oversight for WMin/PP implementation; a base of technical knowledge and resources for WMin/PP practices; assistance with identifying waste generation trends and WMin/PP opportunities; recommendations for WMin/PP solutions and applications; support in tracking and reporting waste generation trends and WMin/PP successes and lessons learned; assistance in preparing funding applications and proposals for WMin/PP projects; and assistance in overcoming WMin/PP implementation barriers.

- The deputy project director for the RRES-RS Project has primar responsibility for developing and implementing WMin/PP programs and strategies for all RRES-RS projects that result in waste generation, as described in this plan. The RRES-RS Project must allocate sufficient resources to attain the goals and approaches identified in this plan. The RRES-RS Project is responsible for establishing and submitting an annual WMin/PP plan to the administrative authority, establishing WMin/PP goals and performance measures, and coordinating with the RRES-PP Program to implement WMin/PP activities and to report success stories.

- The RRES-RS Project Office is the focal point for planning and implementing waste minimization activities and reporting waste minimization successes and lessons learned for the RRES-RS Project. RRES-RS project leaders, who report to the deputy project director, are responsible for identifying and incorporating WMin/PP practices into project plans and field activities, as much as technically and economically feasible.

- The RRES-RS Project waste management and minimization coordinator is responsible for coordination of waste minimization activities, coordinating proposals for waste minimization implementation projects, advising project leaders on Wmin/PP technologies and techniques, recommending RRES-RS Project-wide policy, and compiling waste generation and minimization data.

Goals And Performance Measures

The DOE Headquarters established an annual DOE complex-wide 10% reduction goal for environmental restoration activities based on overall waste projections. Additionally, the University of California FY03 contract performance measures include the same 10% waste reduction goal for cleanup/stabilization activities.

The RRES-RS FY04 WMin/PP approach will focus on:

- integrating waste minimization principles into the remedial planning process;
- recycling and reusing materials;
- using material substitution as appropriate;
- developing subcontractor waste minimization incentives through contract specifications;
- dedicating waste minimization resources to assist with large remedial actions; and
- tracking, projecting, and analyzing waste data to improve waste management economies of scale.

Figure 3-2 shows the environmental hierarchy for RRES-RS Project wastes.

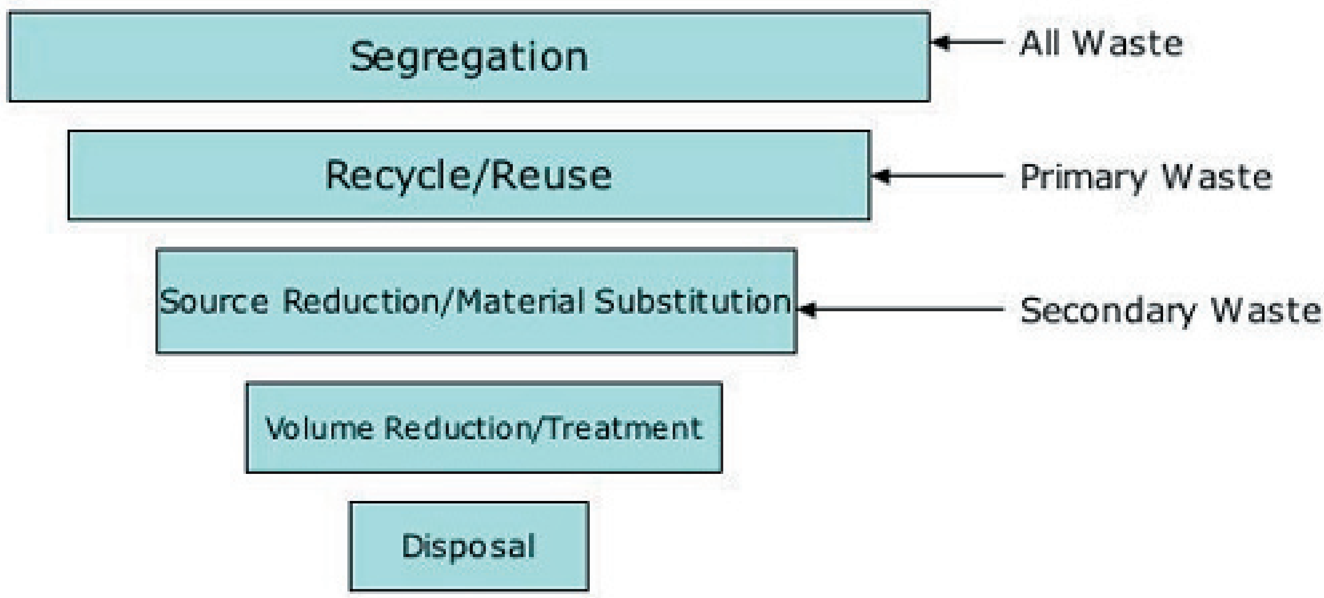

Figure 3-2. Environmental hierarchy

Although source reduction is preferred, the RRES-RS WMin/PP approach recognizes that limited opportunity may exist for source reduction of primary wastes because the RRES-RS Project is tasked to investigate and conduct corrective actions, as necessary, at historically contaminated sites within the Laboratory; potential environmental concerns may require removal of contaminated material. When appropriate, primary waste sources will be reduced through the application of risk-based cleanup criteria and associated land-use scenarios, the consideration of in-situ or non intrusive remediation technologies during project planning and negotiation stages, and improved characterization and segregation during the execution of field activities. Secondary waste sources will be reduced through proper planning; improved housekeeping, segregation, and characterization; and application of WMin/PP criteria during technology selection, design, and construction activities. Recycling and reuse practices will be considered for all primary and secondary wastes. Volume reduction, including size reduction, compaction, and optimal packaging, will be considered for all primary and secondary wastes for which generation cannot be avoided and that cannot be recycled.

The WMin/PP approaches outlined previously are consistent with the waste reduction priorities established by the Laboratory's site wide waste minimization plan, which recognizes the severe limitations of on site disposal capacity for radioactive LLW and of on site storage capacity for LLMW. In addition, the approach was adopted to address the variable and nonrecurring nature of wastes coming from RRES-RS activities.

Situation Analysis

The FY03 activities that resulted in waste generation included remedial actions and site investigations. These types of activities will continue throughout the life of the Laboratory's RRES-RS Project.

It should be noted that the majority of FY03 waste generation was the result of the voluntary corrective measure (VCM) at PRS 21-011(k).

The FY04 planned activities include a voluntary corrective action (VCA)/accelerated land transfer at TA-19, additional deep groundwater characterization and intermediate well installation, and other site investigations and corrective action projects. Corrective action projects will largely be in the planning stages in FY04, with implementation in FY05 and beyond.

Waste Type	FY03 Planned Waste Volume (m3) from RRES-RS and Stabilization Activities	Volume (m3) of waste Targeted for Reduction/Recycle to Achieve Goal	FY03 Waste Generation Volume (m3)
Solid - Transuranic Radioactive	0	0	0
Solid - Mixed Low-Level radioactive	0.8	0	0
Solid - Low-Level Radioactive	1926	192	1864
Solid - Hazardous	3.8	0	30
Solid - Sanitary	89	8.9	565

Table 3-2. FY03 waste generation summary

Waste Type	FY04 Planned Waste Volume (m3) from RRES-RS and Stabilization Activities[a]	Volume (m3) of waste Targeted for Reduction/Recycle to Achieve Goal	Percent Reduction Goal
Solid - Transuranic Radioactive	0	0	10%
Solid - Mixed Low-Level radioactive	5.5	0	
Solid - Low-Level Radioactive	119	12	
Solid - Hazardous	23	0	
Solid - Sanitary	561	56	

Table 3-3. FY04 planned waste generation

Applicable Statutory, Regulatory, and Institutional Requirements

The Laboratory's RRES-RS Project is subject to many environmental regulations. The key drivers for the WMin/PP Program are listed as follows. A complete description of these regulations may be found in the Laboratory's Waste Minimization Awareness Plan or the "Waste Minimization and Pollution Prevention Regulations and Orders, Requirements and Identification List."

Federal Statutes and Executive Orders

Resource Conservation and Recovery Act

Pollution Prevention Act

Executive Order 12873 — Federal Acquisition, Recycling, and Waste Prevention

Executive Order 12856 — Federal Compliance with Right-to-Know Laws and Pollution Prevention

Executive Order 13148 — Greening the Government Through Leadership in Environmental Management

Federal Regulations

Code of Federal Regulations, Title 40, Part 262—Standards Applicable to Generators of Hazardous Waste

Code of Federal Regulations, Title 40, Part 264—Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

Code of Federal Regulations, Title 40, Part 270—EPA-Administered Permit Programs: The Hazardous Waste Permit Program

State of New Mexico Statutes

New Mexico Hazardous Waste Act, State of New Mexico Regulations

New Mexico Solid Waste Management Regulations, Title 20, Chapter 9, Part 1, New Mexico Administrative Code

New Mexico Hazardous Waste Management Regulations, Title 20, Chapter 4, Part 1, New Mexico Administrative Code

DOE Policy

DOE Order 5400.1, "General Environmental Protection Program"

DOE Order 5400.3, "Hazardous and Radioactive Mixed Waste Program"

DOE Order 5400.5, "Radiation Protection of the Public and the Environment"

DOE Order 435.1, "Radioactive Waste Management"

Secretary of Energy Notice 37-92, "Waste Minimization Policy Statement"

DOE Pollution Prevention Program Plan, 1996

Los Alamos National Laboratory Directives and Policies

Los Alamos National Laboratory 2001 Pollution Prevention Roadmap, LA-UR-01-6634, December 2001

Laboratory waste management requirements

Justification for the Use of Hazardous Materials

RRES-RS Project activities currently introduce only small amounts of hazardous materials into field and support operations. During the past years, most use of hazardous materials has been substituted with nonhazardous alternatives in an effort to reduce the generation of secondary hazardous or mixed waste. These efforts include the following:

- Decontamination Solvents—The use of hazardous solvents has been eliminated in the RRES-RS Project.
- Scintillation Cocktails—The routine use of scintillation cocktail media that results in a mixed waste has been discontinued at the Laboratory.
- Analytical Processes—Some samples collected for site characterization may require the use of hazardous chemicals have been evaluated by the EPA, private companies, and universities for potential alternative processes and material substitution. The use of hazardous chemicals for sample preservation currently is viewed as necessary.

Waste generation summary

The RRES-RS Project FY03 waste generation and waste minimization summary is listed in Table 3-2. Waste projections and reduction goals for FY04 are listed in Table 3-3.

Waste Minimization Accomplishments during FY03

WMin/PP was an integral part of the FY03 RRES-RS planning activities and field projects through recycling, reuse, contamination avoidance, risk-based cleanup strategies, and many other practices. Waste reduction benefits are typically difficult to track and quantify because the data to measure the amount of waste reduced (as a direct result of a WMin/PP activity) are often not available and are not easily extrapolated. In addition, many waste minimization practices employed during previous years are incorporated into standard operating procedures and no longer reported. Operating expenses of approximately $50,000 are provided annually to evaluate best management approaches, source reduction, and recycling options.

Pollution prevention capital projects not funded from project funds may also be funded through a Laboratory-wide "Waste Minimization/Waste Generation Set-Aside Tax" system. This system taxes waste generators according to the volumes and toxicity of wastes generated. The RRES-RS Project has previously submitted Return on Investment proposals for WMin/PP projects that are eligible for funding through this program. The Laboratory annually funds over $1M in pollution prevention projects through this program. A list of the projects funded in FY03 can be found at http://emeso.lanl.gov/eso_projects/set_aside/gsaf.html.

High-volume waste streams resulting from RRES-RS activities include contaminated soil and demolition debris such as metal and concrete. The WMin/PP techniques used in FY03 to reduce these high-volume waste streams led to the following accomplishment:

For the voluntary corrective measure at PRS 21-011(k), the RRES-RS Project requested a "no longer contained in" determination from NMED so that excavated sediments containing trace amounts of organic chemicals did not require disposal as low-level mixed wastes. Real-time fixed geometry field screening for primary radionuclide chemicals of potential concern was used to guide excavation and thus, minimize the amount of soil removed. Additionally, approximately 100 trees were removed from the site to facilitate access for VCM activities; instead of disposing of the trees, the branches were removed and they were used as part of best management practices (BMPs) for stormwater runon/runoff. They were used to fill in low areas at the site, and for berm construction when the site was regraded. Because the trees were from a radiological site, they would have otherwise been sent to TA-54, Area G for disposal.

Waste Minimization Program Elements

The following sections present the Laboratory's RRES-RS Project waste minimization program elements for FY03. Several of the elements are currently in place; however, several are in the planning stages. The planned elements will be implemented if they are economically and technically feasible.

WMin/PP Coordinator

The WMin/PP coordinator will have a primary role in FY04 for developing and implementing programmatic planned elements of the RRES-RS WMin/PP Program by conducting the following activities:

- Improve WMin/PP awareness and information exchange within the RRES-RS Project.
- Provide technical reviews and WMin/PP input for RRES-RS documents and procedures, such as corrective measures studies, sampling and analysis plans, other project work plans, and working examples of "model" documents that incorporate WMin/PP elements.
- Provide technical assistance and consistency among RRES-RS projects to formalize standard approaches for WMin/PP in RRES-RS Project plans and procedures and institutionalize the use of design reviews, WMin/PP checklists, or value engineering for WMin/PP applications.
- Assist in developing WMin/PP language for RRES-RS subcontractor documents and project specifications, thus providing incentives and measurable goals for waste reduction.
- Pilot test or demonstrate those site-specific waste reduction activities that have a high potential for immediate return on investment.

The WMin coordinator(s) will provide WMin/PP tools and practices to the RRES-RS Project. The specific application and waste reduction potential of a tool will be dependent on the specific project and will be left to the judgment of the individual project leaders. The common Wmin/PP tools for use in the RRES-RS Program are summarized in the following list.

WMin/PP tools for the negotiation and planning phases

- Negotiate with regulators to recognize and implement WMin/PP where appropriate
- Write WMin/PP into RRES-RS Project documents
- Include WMin/PP in budgets and contracts Integrate WMin/PP into construction of engineered structures and best management practices
- Train RRES-RS personnel on WMin/PP and build WMin/PP awareness

WMin/PP tools for the assessment phase

- Conduct efficient sample management and analysis
- Consider alternative sampling techniques
- Consider alternative drilling techniques
- Segregate materials and waste through field screening
- Use site control techniques
- Use bulk waste packaging techniques
- Train RRES-RS personnel on WMin/PP and build WMin/PP awareness

WMin/PP tools for the alternative evaluation and selection phase

- Identify WMin/PP as a key criterion during treatment selection
- Incorporate WMin/PP in key decision-making documents
- Conduct treatability studies that support WMin/PP
- Train RRES-RS personnel on WMin/PP and build WMin/PP awareness

WMin/PP tools for the implementation phase

- Scour and decontaminate building materials
- Recycle and reuse materials from decommissioning activities
- Prevent contamination migration
- Dedicate a person on each RRES-RS project to promote WMin/PP (e.g., a WMin coordinator)
- Reuse equipment
- Train RRES-RS personnel on WMin/PP and build WMin/PP awareness

WMin Planning

WMin/PP is best integrated during the project planning (including design and engineering) phase. WMin/PP strategies incorporated during the planning (and negotiations) phases are some of the few opportunities for "source reduction" because they can avoid or reduce the generation of contaminated soil and building debris, which represent a significant waste volume within the RRES-RS Project. Well-defined agreements (with regulators and stakeholders) regarding land-use scenarios, cleanup performance standards, and risk and pathway scenarios are highly effective in avoiding or reducing these primary wastes (e.g., soil and building debris) and secondary wastes.

The ESH-ID process provides a tool in the planning and design phase to assist Laboratory personnel in identifying and managing environment, safety, and health Laboratory implementation requirements that can impact a project. This process incorporates the evaluation of potential waste-generating activities before project startup and includes review by a waste minimization/pollution prevention subject-matter expert.

Employee Training and Awareness

Waste minimization implementation is most effective when all employees consider WMin/PP to be part of their job responsibilities. To accomplish employee buy-in, a planned approach to building waste minimization awareness has been developed. The goals of the awareness program are to:

- improve recognition among employees that WMin/PP practices apply to RRES-RS activities;
- educate employees about successful implementation at the Laboratory and within DOE; and
- improve documentation of WMin/PP accomplishments.

In addition to awareness activities, during FY03 the Laboratory conducted WMin/PP training for all RRES-RS Project and subcontractor project managers, project leaders, field team leaders, and waste management coordinators. The training was focused on WMin/PP opportunities for RRES-RS fieldwork and the education of all personnel regarding the WMin/PP tools available to the RRES-RS Project.

In addition to the above formal training, all RRES-RS waste management coordinators are required to attend quarterly meetings for ongoing training in issues important to performing the duties of a waste management coordinator, including periodic updates from the RRES-PP Program.

Laboratory managers are required to attend integrated safety management training, which addresses the management of all environment, safety, and health issues, including waste minimization and pollution prevention awareness.

Information and Technology Introduction

The introduction of new technologies for WMin/PP and waste management approaches is important to minimizing wastes. To support technology exchange, the waste minimization coordinator is available to research technologies or WMin/PP tools for RRES-RS Project project leaders as necessary to obtain information on technical or economic feasibility. Some sources for documents include the following.

DOE, Remedial Action Project Information Center, Oak Ridge, Tennessee

DOE, EPIC (the DOE Pollution Prevention Information Clearinghouse), Pacific Northwest Labs, Richland, Washington

EPA, Superfund Innovative Technology Evaluation (SITE) Database

DOE, Technology Information Exchanges Conferences and Abstract Summaries

EPA, Pollution Prevention Homepage Web Site

EPA, Pollution Prevention Clearing House Web Site

EPA, Envirosense Web Site

EPA, National Center for Environmental Publications Web Site

DOE, Environmental Web Site

University of Texas El Paso, Southwest Pollution Prevention Center Web Site

US Navy, Joint Service Pollution Prevention Technical Library Web Site

State of Kentucky, Kentucky Pollution Prevention Center Web Site

DOE, Oak Ridge National Laboratory Pollution Prevention Web Site

Tracking and Reporting

The routine collection of data regarding waste minimization was established in FY96. Project managers are asked to provide documentation of accomplishments as they occur and in formal quarterly data consolidation reports.

Sort, Decontaminate, and Segregate

This task currently is implemented and designed to sort and decontaminate recyclable/recoverable radioactive LLW materials from decommissioning operations for the purpose of eliminating their disposal at TA-54 as radioactive LLW. Typical sorting practices include collection of all metal debris (including steel and lead) in separate boxes destined for shipment to a decontamination facility or commercial smelter for metals recovery. Decontamination work will involve the removal of surface radioactive contamination on equipment to allow for its reuse either at LANL or other DOE facilities. Additionally, many sites containing radioactively contaminated heterogeneous materials will place emphasis on proper segregation at the source to attain the maximum recycling and waste classification advantages.

Compaction

The RRES-RS Project plans to improve this process by using the compaction unit at TA-54 to reduce the volume of suitable waste before final disposal. The compactor at TA-54 has a higher compaction yield than past equipment.

Survey and Release

Past practices conservatively have classified non indigenous investigation-derived waste (e.g., personal protective equipment, and sampling materials) as contaminated, based on association with contaminated areas. New policy within the Laboratory allows the RRES-RS Project to develop procedures to survey and release these materials as nonradioactive. This survey and release will reduce the volume of radioactive LLW disposed of at Area G from RRES-RS activities. Waste management coordinators will be trained in the Laboratory occupational radiation protection requirements.

Risk Assessment

Risk assessments routinely are conducted for RRES-RS Project projects, as prescribed in the Laboratory's Installation Work Plan (LANL 1998, 62060). Risk assessments allow the RRES-RS Project to plan remediation activities on the basis of the future risk to human health and the environment. Often the risk assessment may determine that it is adequately protective and appropriate or beneficial to leave the material in the ground, thus avoiding the generation of waste.

Properly designed land-use agreements and risk-based cleanup strategies can provide flexibility to select remedial actions (or other technical activities) that may avoid or reduce the need to excavate or conduct other actions that typically generate high volumes of remediation waste. Here is one of the few opportunities available to the RRES-RS Project for source reduction.

Incentives

The Laboratory's RRES-PP Program and DOE Headquarters sponsor annual pollution prevention awards programs. Both of these programs provide financial awards and recognition to personnel who implement PP projects.

The RRES-RS Project participates in the Laboratory-wide "Waste Minimization/ Waste Generation Setaside Tax" system. This system charges waste generators according to the volume and toxicity of wastes generated. Reducing this financial burden is an incentive for waste generators to minimize waste generation, thus lowering total project costs. The RRES-RS Project previously has submitted return-on-investigation proposals for WMin/PP projects that are eligible for funding through this tax system. The Laboratory annually funds more than $1M in pollution prevention projects through this program.

Lead-Handling Procedures

The RRES-RS Project does not routinely procure or use lead or handle excess lead. The inventory and decontamination of existing lead at the Laboratory has been conducted as part of a milestone of the Laboratory's Federal Facilities Compliance Act agreement and is outside the scope of the RRES-RS Project.

RRES-RS personnel will manage and minimize the amount of lead-contaminated waste using the following approaches.

- Projects will specify a preference to avoid the procurement or use of lead, when possible, giving preference to the use of steel in place of lead.
- Projects will specify the use of stripable or washable coatings for any lead materials that must be used and have the potential to become contaminated.
- Projects will plan for the decontamination of lead materials, when economically feasible, using blast grit, carbon dioxide blast (or other nondestructive blast), or chemical decontamination techniques. Preference will be given to decontamination techniques that minimize the generation of secondary waste (from the treatment process).
- Projects that handle noncontaminated lead waste as a primary waste from the removal action or decommissioning activity will make efforts to recover and redistribute the lead for use at the Laboratory or at another DOE facility.
- Projects will coordinate with the Laboratory's Solid Waste Operations Group for the appropriate handling and disposition of radioactively contaminated lead that cannot be decontaminated or redistributed.

Equipment Reuse

The reuse of equipment and materials (after proper decontamination to prevent cross contamination) such as plastic gloves, sampling scoops, plastic sheeting, and personal protective equipment will produce waste reduction and cost savings in FY04.

In addition, the Laboratory has initiated an equipment-exchange program that identifies surplus or inactive equipment available for use. This program not only eliminates the cost of purchasing the equipment, but it also delays the point at which the equipment is no longer needed and must be disposed of.

Barriers To Waste Minimization Implementation

In some instances, regulatory requirements created situations where levels of waste minimization achieved fell below potentially achievable levels based on site conditions. Examples follow:

- The RRES-RS Project prepared a VCM plan for PRS 21-011(k) that called for stabilizing contaminated sediments in place. In order to minimize future long-term stewardship requirements associated with the stabilized sediments, DOE opted to change the VCM approach to excavation and disposal of the sediments. This revised approach resulted in generation of larger volumes of waste during the VCM than initially planned.
- Laboratory environmental requirements to protect wetlands, which result in continued National Pollutant Discharge Elimination System-permitted discharge of waters into canyons throughout the Laboratory, may result in additional transport of contaminants. Although this practice may result in greater remediation waste volumes in the future, it provides the benefit of protecting wildlife and wetlands.
- Because of the DOE moratorium on release of metals from radiological controlled areas, recycling has not been implemented for materials that would generally be recyclable.

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Chapter 4: Roadmap - Future Waste Projections

Introduction

This chapter presents a 10-year forecast of Los Alamos National Laboratory (LANL) hazardous and radioactive waste volumes. The waste volume forecast was prepared to support strategic planning for waste management operations and facilities. Knowledge of expected waste volumes will aid waste generators, program managers, and waste management operational organizations in long-term planning and will help ensure that the Laboratory has the right capabilities in place to support programmatic operations. This information will also aid the Laboratory in targeting activities for waste minimization opportunities.

Laboratory Implementing Requirement (LIR) 404-00-02.3 requires that waste generators provide waste forecasts on request for any treatment, storage, and disposal facility to which they discharge waste. The Department of Energy (DOE) also requires waste forecasts for the Integrated Database and the Baseline Environmental Management Report.

This introduction describes the approach and process used in developing the volume forecasts and then presents a discussion of the volume forecast data and any potential impacts to LANL activities. Projections were made based on historical data combined with both near- and long-term program plans. It should be noted that the 10-year forecast is based on many assumptions. The near-term forecasts rely on relatively good information from managers directing currently funded programs/projects. The long-term forecasts were based on program/project manager expectations of long-range potential future funding. Forecasting is uncertain by nature, and thus, users are cautioned when using out-year forecasts. The near-term forecasts are likely to be more reliable than the longer-term forecasts. The data will be updated annually, and over time, the uncertainties should decrease and the usefulness of the information should improve. An attempt was made to tie projected waste generation to major programs within each division. The actual volumes will vary from this estimate; however, the forecasts provide a good basis for planning decisions.

The approach used in this study was to identify the organizations, programs, and projects that are responsible for the majority (>80%) of the waste by type. These activities were selected for detailed inquiry and modeling. The remaining 20% were simply extended based on historical trends.

Data Collection

Data were collected from the LANL divisions, programs, and projects by analysts familiar with environmental/WM practices at LANL. An initial query of existing data sources was performed to identify historical generation and to identify the divisions that generate most of the waste. Data sheets were prepared with historical trends and a preliminary forecast developed from existing sources such as the FWO-solid waste operations (SWO) waste database, LANL Site-Wide Environmental Impact Statement (SWEIS) data, Environmental Management (EM) Integrated Planning and Budgeting System data, Waste Management Facility Strategic Plan, and other sources. The forecast is based on FY02 data.

After the waste generating activities were identified and a baseline volume was established, program/project contacts were identified. The responsible managers for each key program/project then were interviewed regarding their vision of the next 10 years. Based on these interviews, relative values (delta factors) of program-waste-generating activity were developed. These values measured future program activity relative to the baseline year.

This approach is not perfect; however, it does provide a reasonable way to formulate waste volumes based on out-year program plans. Generally, the waste management professionals understand the historical volumes, but they do not have a good idea of what the programs are planning. On the other hand, the program managers understand the future of their activities, but their understanding of the waste volumes to be generated is limited. This approach combined the best information from both sources.

TRU WASTE

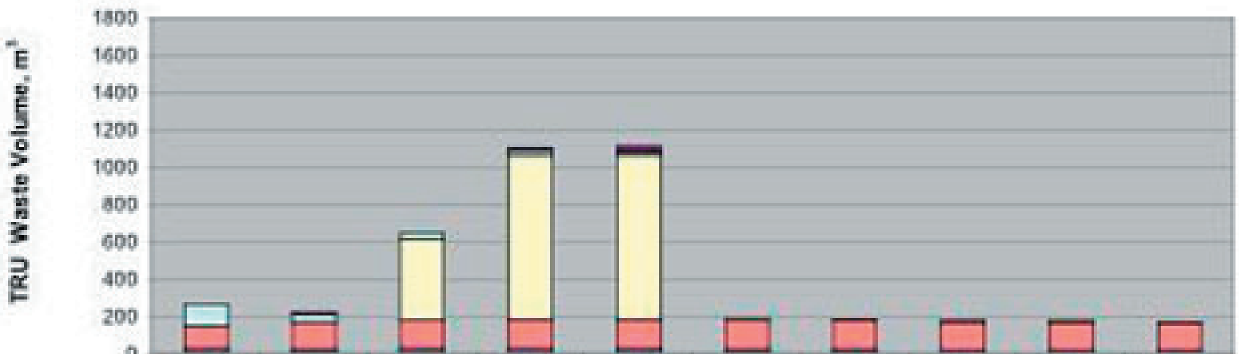
Forecast and Analysis

The TRU waste volumes reported by year in this projection include routine, nonroutine, newly generated, and legacy TRU wastes; thus, totals will not agree with TRU waste generation volumes reported in the Chapter 2, TRU Waste. Chapter 2 reports only routine waste data. Routine waste is defined as waste produced from any type of production operation, analytical, and/or research and development (R&D) laboratory operations; treatment, storage, and disposition facility operations; "work for others"; or any other periodic or recurring work that is considered ongoing in nature. Nonroutine waste is defined as one-time operations waste: wastes produced from environmental restoration program activities, including primary and secondary wastes associated with retrieval and remediation operations; legacy wastes; and D&D/transition operations.

The average generation of (all) TRU waste over the past 11 years has been 148 cm3/yr. Volumes have been trending higher for the past decade as the Laboratory's nuclear materials mission at Technical Area (TA)-55 has expanded and as legacy waste is processed.

TRU waste generation is predicted to increase somewhat over the next 10 years. The last year of TRU waste volume decrease will likely be FY04. The dominant activity that will drive changes in the volume of waste sent for disposition is the

Figure 4-1 TRU waste generation forecast



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, cubic meters	264	218	643	1,100	1,108	185	179	172	171	165
RRES-ER, m3	0	9	0	13	31	0	0	0	0	0
RRES-OSRP	116	40	30	30	20	10	5	5	5	3
RRES-2010	0	0	437	873	873	0	0	0	0	0
NMT Routine	126	148	156	163	163	154	154	150	149	145
NMT Nonroutine	17	17	17	17	17	17	17	17	17	17
FWO	5	3	4	4	4	4	4	0	0	0

Fiscal Year

EM waste disposal project that will retrieve ~1800 m3 of legacy waste currently located below

ground at TA-54. The Offsite Source Recovery Project (OSRP) will continue to retrieve sealed sources from around the country in preparation for treatment and disposal. The nuclear material stabilization project will see increasing activity through the middle of the decade and then a tapering off in the second half. Pit manufacturing, heat sources, and energy programs are expected to see a 40% increase in activity over the next several

years and then continue at elevated levels through the remainder of the decade. Volumes of TRU waste will be increased by the cleanout of legacy waste from the NMT vault.
The older vault material has a high curie content and thus will require a greater packaging volume, which will add to the overall volume increase. These increases will be offset partially by increased waste minimization activities. Projected TRU volumes are shown in Fig.4-1.

The primary issue related to TRU waste volumes is the limited above-ground storage capacity at LANL. From FY05 to FY07, large quantities of legacy TRU waste are scheduled to be retrieved from underground storage for processing, repackaging, and shipment to the Waste Isolation Pilot Plant (WIPP). It is not expected that this waste will impact LANL storage facilities significantly because the waste will not be retrieved until sufficient storage space has been created by TRU shipping operations. Further, the schedule is flexible, and although it is projected to begin in FY05 and take 3 years to complete, it can be delayed or extended or both to adjust to the availability of storage space. However, retrieving the legacy waste will require new and modified capabilities for the retrieval operation itself because this waste is located deeper underground than waste previously retrieved and because it is packaged in various containers of unknown integrity.

The general short-term trend is toward increased waste volumes due to expanded NMT program activities; thus, LANL and NMT will need to find additional opportunities for waste minimization. The DOE Secretary's goal for waste minimization requires overall reductions in the quantity of newly generated routine TRU waste sent to TA-54 by 2005. It seems likely that this goal will not be met due to increasing mission related activity.

Improvement Projects

Many process improvements have been identified for implementation within TA-55 and in the processing of TRU waste after it is produced. Priorities for new waste minimization projects and activities within TA-55 are detailed in the integrated TRU Waste Minimization Management Plan prepared by NMT Division in FY01. Many of the projects detailed in that plan have been terminated for technical or programmatic reasons. The remaining projects are divided into projects completed in the last year and projects currently funded. Most of the projects completed in previous years continue to avoid and minimize TRU waste.

Completed TRU Waste Minimization Projects

Nitric Acid Recovery System (NARS) . The NARS was fully implemented in this past year. Additional transfer lines are being installed in PF-4 to make the recycled acid available to more users. The requirements of the MOX program are being reviewed to determine if NARS acid can be used for future production efforts.

Decontamination and Volume Reduction System (DVRS) . The DVRS is designed for the decontamination and size reduction of oversized TRU waste items, including gloveboxes and process equipment. It consists of an outer building that provides secondary containment and storage and preparation space and an inner building that houses a shear-bailer volume reduction machine and provides segmented space for removal of packaging and decontamination of the waste materials. Currently, the DVRS processes TRU waste that is less than the Category 3 radiological limits (8.4 g of 239Pu equivalent). The DVRS will become a Nuclear Category 3 facility and will be able to process waste with an inventory up to 900 g of 239Pu equivalent after approval of new Authorization Basis Documents.

Ongoing TRU Waste Minimization Projects
These projects have been funded and currently are being executed. These ongoing TRU waste minimization and avoidance projects are funded by the Prevention Program (PP) Office and GSAF programs and by operating funds.

Small Scale Granulator and Compactor for PF-4 TRU Waste . This project proposes to use waste minimization to reduce the volume of the current inventory of radioactive contaminated plastic bottles and ceramics by at least 60%. Over the last year a smaller scale granulator has been tested for use in an existing glovebox in PF-4. With the space limitations at PF-4 and the focus on new programs, a full-scale system (glove box, granulator, and a material transport system) clearly could not be integrated at TA-55 in a timely fashion. Focusing on a smaller granulator will ensure fast and safe deployment of a small and efficient granulation and compactor system into an existing glove box that will fit in the space allocated at TA-55.

Vitrification System. The PP Office is funding the fabrication, testing, and installation of a vitrification process for the TRU waste that currently is solidified with cement. The project provides for the fabrication and installation of gloveboxes to house the vitrification equipment, fabricate and operationally test the vitrification system, and install the equipment within the gloveboxes in TA-55 PF-4. The Vitrification System will produce waste drums certifiable to WIPP waste acceptance criteria (WAC) and is expected to reduce the generation of TRU/MTRU cemented waste at a rate of 20 to 30 drums per year. This is the largest single technical project in the LANL P2 program with total funding of over $750 K per year and a total cost of over $6 M.

PF-4 Trichloroethylene Upgrade . The processes for cleaning plutonium parts at TA-55 are being reviewed for a series of upgrades designed to reduce the amount of waste generated, reduce the exposure levels of the operator to both radiation and solvent, and aid in removing any inconsistencies in the level of cleaning. Central to these upgrades is the proposed replacement of the ultrasonic bath currently in use with a mechanical spray washer developed by the Weapons Component Technology Group, NMT-5. A second development designed to reduce the amount of waste generated further is the proposed installation of a distillation recycle unit in conjunction with a fluorometer and pH meter to monitor the organic contaminant loading and TCE breakdown. Combined, these process modifications will reduce the annual volume of TCE waste by >95%.

These improvements, when completed are expected to reduce routine TRU waste generation by as much as 30 - 50 m^3per year.

LOW-LEVEL WASTE

Forecast and Analysis

The LLW waste volumes reported by year in this projection include routine, nonroutine, newly generated, and legacy wastes; thus, totals will not agree with waste generation volumes reported in the Chapter 2, Low-Level Waste. Chapter 2 reports only routine waste data. Routine waste is defined as waste produced from any type of production operation, analytical, and/or research and development (R&D) laboratory operations; treatment, storage, and disposition facility operations; “work for others”; or any other periodic or recurring work that is considered ongoing in nature. Nonroutine waste is defined as one-time operations waste: wastes produced from environmental restoration program activities, including primary and secondary wastes associated with retrieval and remediation operations; legacy wastes; and D&D/transition operations.

The average generation of LLW over the past 10 years has been 2850 m3/yr. The total volumes have been fluctuating strongly for the past decade,primarily because the nonroutine and ER volumes increase sharply in years in which decontamination, demolition, and remediation activities increase. The generation of routine LLW has been trending downward over the past few years but sharply increased in FY03.

Total LLW generation is predicted to remain volatile over the next 10 years. The activities that will drive the volatility in total waste volume are the ER project, NMT mission-related activities and DX Division testing. The volumes of waste generated by the ER project will be substantial through FY08, with peak activity occurring in FY07. Although small changes in non-ER waste generation are projected to occur, the total non-ER waste volume is expected to remain relatively constant. NMT is producing greater volumes of LLW because of increased efficiency in sorting TRU waste and LLW. Material that was previously disposed of as TRU waste is now being classified and disposed of as LLW.

In addition, periodic cleanout of NMT facilities generates large volumes of LLW.

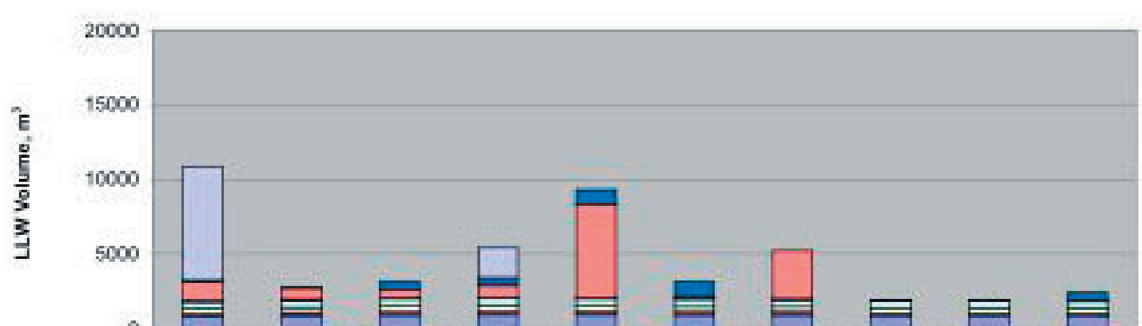
Figure 4-2 presents the predicted LLW volumes through FY12 by division, although this estimate may be significant low in the short term.

Solid LLW generated by the Laboratory's operating divisions is characterized and packaged for disposal at the on-site LLW disposal facility at TA-54, Area G. Area G has a limited useable volume. An FY03 analysis of the LLW landfill at TA-54 indicated that 11,200 m3 remained for LLW disposal. The ER project plans the generation of very large volumes of contaminated soil waste over the next few years. The estimates range from 10,915 m3 (projected by John Kelly) to 13,000 m3 (projected by Skip Natalie of PS-4).

In either case, the ER project could use all of the remaining volume at the LLW disposal trench in a just a few years. When packaged LLW, low-level construction waste, and low-level D&D waste are added to the ER LLW, the planned volume will exceed the remaining disposal volume by FY04–05. Waste produced from D&D and ER projects are low-activity wastes and can be disposed of at the Envirocare site in Utah. Because the SWEIS (through a DOE Record of Decision in the fourth quarter of 1999) has received regulatory approval, construction of additional disposal sites now is allowed. Additional sites for LLW disposal near Area G could provide on-site disposal for many years. However, the preferred option may be to reserve the new burial sites for higher-activity LLW that cannot travel over the highway. This would mean sending most of the LLW to Envirocare for disposal. Cost is the issue with shipping lower-activity LLW off site for disposal.

Improvement Projects

The following projects were identified as potential corrective measures for the LLW type.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, cubic meters	10,826.61	2,709.23	3,113.37	5,382.37	9,264.00	3,107.90	5,177.37	1,899.35	1,870.25	2,360.73
Const.	7,600.00			2,000.00						
D&D	135.00	20.00	500.00	500.00	1,000.00	1,000.00	0.00	0.00	0.00	500.00
ER	1,274.00	742.00	593.00	839.00	6,262.00	114.00	3,192.00	24.00	0.00	0.00
RLWTF	52.67	52.67	52.67	52.67	52.67	52.67	52.67	52.67	52.67	52.67
FWO	483.14	499.46	508.97	515.67	509.21	501.03	499.71	495.45	493.96	491.19
LANSCE	341.90	354.40	354.40	354.40	341.90	341.90	341.90	341.90	341.90	341.90
MST	105.86	179.43	219.93	219.93	220.73	220.73	218.73	121.33	121.33	121.33

Fiscal Year

Figure 4-2. LLW generation forecast

These projects are divided into three categories:

(1) projects completed in the last year, (2) projects currently funded and ongoing, and (3) unfunded proposed projects.

Completed Projects

These projects have been completed and/or implemented in the last year. Many projects completed in previous years, especially sort and segregate and recycle/reuse projects, continue to avoid LLW.

Glovebag/Enclosure Implementation Pilot. This project was designed to specifically reduce job control waste by replacing plastic and wood used for the construction of temporary containment structures with plastic enclosures that can be used multiple times. Several enclosures were successfully demonstrated as part of this pilot and are now being used routinely at the laboratory. It is expected that routine use of these enclosures could reduce the non-capactable routine waste generated by NMT division by 50 to 100 cubic meters annually.

Ongoing Projects

These projects have been funded and currently are being executed. All of the ongoing LLW projects are funded by the Prevention Program (PP) Office Base and Generator Set-Aside Fee (GSAF) Program.

GIC. It is estimated that 50% of the LLW stream is not contaminated. Through the use of acceptable knowledge and segregation techniques, a large portion of this waste stream can be eliminated. A verification facility with sophisticated counting instrumentation was established at TA-54 to perform verification surveys on waste that was segregated based on acceptable knowledge before it was disposed of as sanitary waste. In addition, sitewide implementation procedures were developed. The PP still supports this project as part of its base program activities. Support consists of working with generators to define acceptable knowledge and segregation techniques better. In FY02, a GSAF project was initiated to enhance the throughput of the GIC waste verification facility from 50 to 100 m3 annually.

Launderable Product Substitution. This project increases the use of launderable PPE at the Laboratory to eliminate disposable PPE. The PP Office still is supporting this project as part of its base program to encourage the use of launderable wipes, mops, bags, and contamination barriers to eliminate further the use of disposable products. In FY02, a GSAF project to implement the use of launderables to minimize job control waste at TA-55 was funded.

Job Control Waste Minimization. Large quantities of paper and plastic waste are generated during operational and maintenance activities at the Laboratory and must be disposed of as LLW. Typically, the floor of the room surrounding the work activity is covered with plastic sheeting. In many cases a temporary wall is built with wooden 2-in. x 4-in. studs and covered with plastic sheeting for additional contamination control. After the work activity is completed, all of this material is disposed of as LLW. This project consists of two elements: a job control waste minimization project within NMT Division and a broader glovebag/enclosure element that includes the use of glovebags at TA-54 as well as at NMT. The NMT project is a 2002 GSAF award project. This project minimizes job control waste by substituting launderable materials, glovebags, and other job control waste minimization techniques for single-use waste-control items.

The broader project will deploy and pilot containment systems that have been in wide use elsewhere for years. These containment systems consist of everything from small glovebags, built from plastic sheeting, that are designed to fit around a specific work activity to large plastic tent-like structures for larger work activities. The tent-like structure can be erected easily and then disassembled and stored for future use if it is not contaminated. Otherwise, the plastic tent can be disposed of and the tent structure reused. The small glovebag systems generally are disposed of after a single use. In either case, the amount of LLW generated is significantly less than the waste generated by protecting the entire area around a work activity.

Compactor Box Deployment to RCAs. LLW is placed in 2-ft3 cardboard boxes or large (96-ft3 or 48-ft3) steel waste containers for disposal. Large amounts of job control waste and other compactable waste are placed in the large steel containers (B-25 boxes) because they are too large to fit in the small cardboard containers. These materials cannot be compacted. Use of the steel compactor boxes is not possible because Business Operations (BUS) Division will not certify these boxes for transportation on a public highway. This project will fund the design for new compactor boxes that meet the transportation requirements so that these large materials can be compacted and the volume of the LLW stream reduced. In addition to meeting the transportation requirements, the new boxes will be designed to meet the security (lockable) requirements for TA-55.

Project Development and Unfunded Projects

DX Firing Sites Waste. New requirements for the confinement of DX division tests have resulted in a significant increase in LLW generated by this division. This project development activity will concentrate on identifying alternatives to the current confinement methods to reduce waste generation and to seek funding for these alternatives.

MIXED LOW-LEVEL WASTE

Forecast and Analysis

Most of the Laboratory's routine MLLW results from stockpile stewardship and management and from R&D programs. Most of the nonroutine waste is generated by off-normal events such as spills in legacy-contaminated areas. ER and waste management legacy operations also produce MLLW.

The average generation of MLLW over the past 10 years has been 79.2m3/yr. Total volumes have fluctuated for the past decade primarily because of the strong variation in nonroutine and ER volumes. Routine MLLW generation has trended lower over the same time period.

The generation of routine MLLW has been trending downward over the past few years, and that trend is expected to continue over the next decade. However, the total MLLW generation has been volatile and is predicted to remain somewhat volatile over the next 10 years. The activity that will drive the volatility in total MLLW volume is the ER project. As with LLW, the volumes of waste generated by the ER project will be substantial through FY08, with peak activity occurring in FY07. Although small changes in non-ER waste generation are projected to occur, the total non-ER waste volume is expected to remain relatively constant or to decrease slightly.

Figure 4-3 presents the predicted MLLW volumes through FY12 by division.

Routine MLLW is generated in radiological control areas (RCAs). Hazardous materials and equipment containing RCRA materials, as well as MLLW materials, are introduced into the RCAs as needed to accomplish specific activities. In the course of operations, hazardous materials become contaminated or activated and are designated as MLLW when the item reaches the end of life and is declared waste.

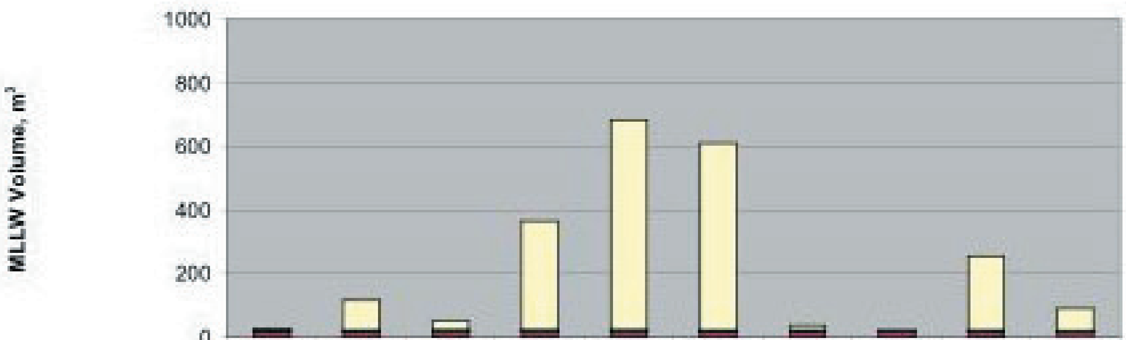
Typically, MLLW is transferred to a satellite storage area after it is generated. Whenever possible, MLLW materials are surveyed to confirm the radiological contamination levels; if decontamination will eliminate either the radiological or the hazardous component, materials are decontaminated and removed from the MLLW category.

Waste classified as MLLW is managed in accordance with appropriate WM and Department of Transportation requirements and shipped to TA-54. From TA-54, MLLW is sent to commercial or DOE treatment and disposal facilities. The waste is treated/disposed of by various processes (e.g., segregation of hazardous components and macroencapsulation or incineration).

Because virtually all MLLW is shipped off site for treatment and disposal, the consequence of increased MLLW generation for the Laboratory is cost. However, the current projections call for nearly stable generation rates except in mid-decade. No significant impact to infrastructures or operations is forecast.

Improvement Projects

The following projects were identified as potential corrective measures for the MLLW type. These projects are divided into three categories: (1) projects completed in the last year, (2) projects currently funded and ongoing, and (3) unfunded proposed projects.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, cubic meters	24.58	116.12	50.28	366.38	682.34	610.12	38.08	22.99	254.97	89.90
ER	2.00	93.00	27.00	343.00	659.00	587.00	15.00	0.00	232.00	68.00
FWO	4.13	4.21	4.24	4.26	4.25	4.21	4.20	4.18	4.18	4.17
LANSCE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NMT	16.56	16.91	17.04	17.12	17.09	16.91	16.88	16.81	16.79	16.73
MST	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00

Fiscal Year

Figure 4-3. MLLW generation forecast

Completed Projects

These projects have been completed and/or implemented in the last year. Many projects completed in previous years, especially sort and segregate and recycle/reuse projects, continue to avoid MLLW.

Oil-Free Vacuum Pumps. This project piloted the replacement of oil-filled vacuum pumps used in RCAs. Oil-free replacement pumps were purchased to replace the oil-filled pumps. The use of these pumps eliminated nearly all of the MLLW oil produced at certain Laboratory facilities. Because of this successful pilot, the use of oil-free vacuum pumps in RCAs is being expanded.

TA-48, RC-45 Nitrate Waste Elimination. The bioassay laboratory at TA-48, RC-45 generates 1 m3 of MLLW annually. This waste is liquid nitrate waste that can no longer be disposed of at the RLWTF. Currently, this waste is being accumulated in carboys and sent off site for disposal as MLLW. Because of the low radiological levels present in this waste stream, the waste can be discharged to the Sanitary Wastewater Systems Consolidation (SWSC) facility. To discharge the waste to this facility, a sump, collection, and neutralization system must be installed to route this waste to the SWSC facility. This proposal seeks the funds to install this system. After installation, this facility no longer will generate this waste stream.

Ongoing Projects

These projects have been funded and currently are being executed. All of the ongoing MLLW projects are funded by the Prevention Program (PP) Base and Generator Set-Aside Fee (GSAF) Program.

Sorting, Segregation, Recycle, and Reuse of Electronic Equipment. Miscellaneous electronic equipment leaving RCAs is disassembled, and the individual components are surveyed. Those components that are nonradioactive are recycled. It is estimated that this project avoids up to 10 m3 annually of MLLW generation.

Sorting, Segregation, Recycle, and Reuse of Miscellaneous Equipment from RCAs. Equipment or materials (copper pipe with lead solder joints) are disassembled and surveyed. Materials that can be determined as nonradioactive are recycled.

Oil Solidification. Contamination of oils with radioisotopes is a common problem in RCAs. These oils become MLLW and must be disposed of as such. Recent tests, using the NoChar solidification media developed at Mound Laboratory, indicate that if the oil is solidified with this product, the oil would pass toxic-characteristic leaching-procedure (TCLP) testing and could be buried as LLW, saving substantial waste disposal costs. This project is providing the data necessary to adopt and use this technology for routine management of contaminated oil wastes. When implemented, it is estimated that this process will eliminate up to 0.75 m3 of MLLW generation annually.

Project Development and Unfunded Projects

These projects either have been proposed or are under development to help reduce MLLW. Proposed projects that currently are unfunded and projects under development are designated as such.

Improved Plutonium and Americium Analytical Methods for Environmental Matrices. Current methods for radioisotopic analyses of plutonium and americium in soil and water samples by alpha spectrometry performed by the Isotope and Nuclear Chemistry Group in the Chemistry Division (C-INC) largely were developed 15 or more years ago. Several modifications to the digestion, separation, electroplating, and counting steps of these methods, which should significantly improve the overall analyses, have been proposed. For soils, the aliquot size will be reduced from 10 to 5 g, and the count length will be increased from 22 to 50 hours to maintain the current sensitivity level of 0.002 pCi/g soil. For water samples, the current sample size will be maintained but the count length will be increased to 50 hours, resulting in improved sensitivity. Operational benefits include a reduction in both liquid waste discharges and airborne emissions, improvements in operational efficiency, reductions in the cost and time required to complete the analyses, reduced exposure to hazardous chemicals to workers, and simplification of operations. These benefits will extend to future years.

Reduction of Total Nitrate-Containing Waste in Sample Coprecipitation Methods. This project proposes a modification of current methods to reduce the production of total nitrate waste in the urine bioassay for uranium and americium. Modifications in the precipitation and ion-exchange steps may result in the elimination of ~70% of the total nitrates produced by the current process. New ion-exchange technology has yielded a class of resins that requires much smaller volumes and a lower concentration of acids. Precision and accuracy of the data produced by these new technologies are unchanged. Changes in coprecipitation and the use of these new resins could reduce the total nitrates produced in this preliminary step. Added benefits include a reduction in both liquid waste discharges and airborne emissions, improvements in operational efficiency, reductions in cost and time required to complete the analyses, reduced exposure of hazardous chemicals to workers, and simplification of operations.

Mercury Amalgamation. The Laboratory does not use the treatment standard for disposal of elemental mercury (i.e., amalgamation). The Laboratory adds elemental mercury to the debris collected during spill cleanup activities, although it is much more cost effective to amalgamate the elemental mercury so that it can be handled as a non-RCRA waste. Mercury spills generated in radiological areas generate MLLW, which frequently has no path to disposal; disposal also is very expensive when it is an available option. This project would develop suitable methods to collect and amalgamate elemental mercury during spill cleanup activities and avoid the generation of this MLLW stream.

Paint Debris Elimination.
Although the Laboratory has implemented the use of non-hazardous stripping materials for paint removal, the Laboratory is still generating significant quantities of hazardous paint debris due to the continued use of paint containing hazardous materials and the use of hazardous solvents. This project will identify alternatives to the current paint and solvents and will seek funding for these alternatives.

If these projects are implemented, the Laboratory expects to see a significant reduction in MLLW next year. These projects address only the routine components of the MLLW stream.

RADIOACTIVE LIQUID WASTE

Forecast and Analysis

For the purposes of this forecast, RLW is defined as all waste influent to the Radioactive Liquid Waste Treatment Facility (RLWTF) located at TA-50. The RLWTF has been treating aqueous low-level wastewaters from LANL facilities since 1963. The plant is capable of treating in excess of 20,000,000 liters per year (LPY) of wastewater. Some 1800 drains and other sources attached to the RLW industrial collection system connect 15 TAs, 13 facility management units, and 62 buildings to the TA-50 plant. TAs 54, 21, and 16 do not have direct connections to the main RLW industrial waste line, and any wastes from these areas are trucked to the TA-50 plant. The remainder of the Laboratory's TAs discharge wastewater directly to RLWTF through the plant's main industrial line. Much of the wastewater discharged to the RLWTF industrial wastewater line is not radioactive. In addition to the main industrial wastewater line, two smaller lines connect TA-55 with TA-50 and exclusively carry acid and caustic radioactive wastes.

The average generation of RLW waste over the past 11 years has been ~20 million liters per year (LPY). Volumes have been trending lower for the past 4 years because the Laboratory's waste minimization program has removed nonradioactive sources from the RLW collection system.

RLW waste generation is not predicted to change significantly over the next 10 years. The dominant activities that will drive any change include the waste minimization program and continuing efforts to divert nonradioactive liquid wastes currently being sent to the RLWTF. The nuclear materials programs at TA-48 and TA-55 and at the TA-03 Chemistry and Metallurgy Research (CMR) and Sigma facilities will continue to drive future generations. The planned increase in activity in the pit-manufacturing and other NMT programs is expected to increase

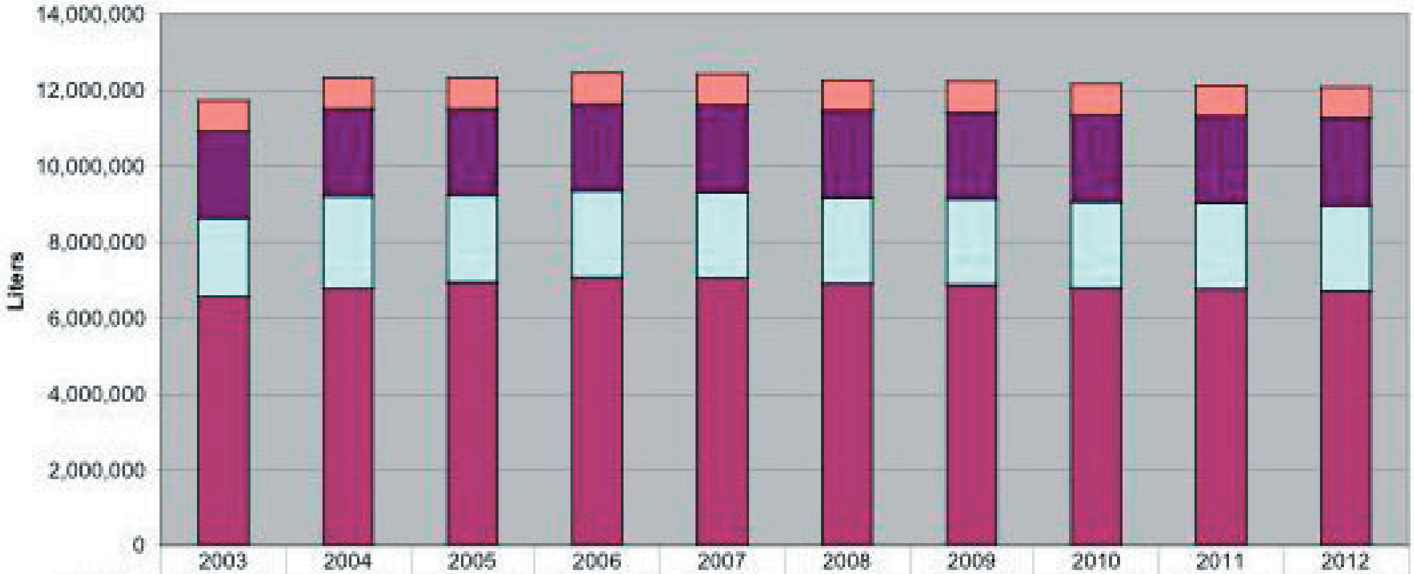
RLW flows in the same degree as the predicted increases in TRU waste volumes.

Figure 4-4 presents the predicted RLW volumes through FY12.

TA-55 generates both acidic and caustic wastes that are transferred to the RLWTF through waste lines. These lines are separate from the industrial waste line through which the bulk of the TA-55 RLW is transferred.

Caustic liquid waste results from the final hydroxide precipitation step in the aqueous chloride process. Feedstocks for this process typically are anode heels, chloride salt residues, and other materials having a relatively high chloride content. Efforts are underway to upgrade the throughput capabilities of the aqueous chloride process to handle the increased quantities of chloride residues that will result from the work off of legacy waste under the 94-1 Residue Stabilization Program. Caustic process liquids are transferred to the TA-50 RLWTF, Room 60, for final processing via the caustic waste line. Over the next 3 to 5 years, throughput quantities are expected to increase modestly. The

Nuclear Material Stabilization and Packaging Project and the Actinide Processing and Recovery Project produce most of the caustic waste.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Other	804,230	804,230	804,230	804,230	804,230	804,230	804,230	804,230	804,230	804,230
C	2,297,800	2,297,800	2,297,800	2,297,800	2,297,800	2,297,800	2,297,800	2,297,800	2,297,800	2,297,800
MST	2,068,020	2,439,502	2,262,415	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413	2,262,413
NMT	6,561,598	6,775,810	6,957,796	7,086,071	7,060,795	6,904,085	6,878,809	6,797,295	6,768,859	6,715,780

Fiscal Year

Figure 4-4. RLW generation forecast

The general trend in RLW volumes is for steady to slightly increasing waste volumes due to predicted temporary increases in NMT and MST waste volumes. These increases may be offset in whole or in part by waste minimization program activities and the diversion of nonradioactive liquid wastes from the RLWTF. The possible effects of waste minimization are not included in the RLW volume forecast. The RLW program is planning for an eventual transition to zero liquid discharge. To attain zero liquid discharge of RLW, careful planning, new construction, and aggressive influent minimization activity will be required.

Superficially, it would seem that the current facility and strategy for collecting and treating RLW is adequate. In the recent past, the facility has handled ~20 million liters of RLW, about twice the Acidic liquid waste is derived from processing plutonium feedstock using nitric acid for matrix dissolution. Following oxalate precipitation, the effluent is sent to the evaporator, where the overheads are removed and sent via the acid waste line to TA-50 RLWTF, Room 60, for final processing. The acid waste stream must be neutralized before treatment, which requires the addition of NaOH. The total effluent is increased because of the addition of neutralizing NaOH. The acid waste stream is expected to increase dramatically in FY03 and then to decrease sharply beginning in FY04 as the Nitric Acid Recycle System (NARS) comes on line and more acid is recycled. The actinide-processing-and-recovery, pit-fabrication, and mixed-oxide waste programs produce most of the acid waste. Because current plumbing in PF-4 precludes the use of recycled nitric acid in many programs, large volumes currently are being produced. When the NARS upgrade is complete, this volume effectively will be eliminated.
current volume. The ~20 million liters was processed in a regulatory environment far different from the present environment. With today's more stringent regulatory requirements, the facility is only marginally adequate for current volumes and could operate at former volumes only with very great difficulty. At current volumes there is insufficient effluent tankage at peak periods. It is questionable

whether environmental compliance of the RLWTF effluent can be maintained in an aging, inflexible facility in an increasingly stringent regulatory environment, even at current volumes. The inflexible space at the present RLWTF will not accommodate process upgrades easily.
In addition, although the volume of acid and caustic wastes is small in comparison to the total, these waste streams account for about two-thirds of the radioactivity at the RLWTF. These streams are processed in a separate facility, Room 60, which has very limited throughput capability. Current increases in acid waste discharge to the RLWTF have reached the limit of the Room 60 capability, and any further increases could well impact programmatic schedules.

Other issues at the RLWTF are related to the age of the facility. Maintenance costs are increasing, and waste treatment occurs in more than a dozen rooms on multiple levels, raising as-low-as-reasonably achievable issues (for example, co-mingling areas) and leading to operational complexity and inconvenience at the 40-year-old TA-50-01 facility. In addition, operational concerns exist with the existing facility, such as potential concerns resulting from the use of underground single-walled pipes and tanks, outside operation of the evaporator, and over-road shipping of evaporator bottoms from TA-55.

Improvement Projects

A number of improvement projects are designed to reduce further the quantity of RLW generated and discharged.

Industrial Waste
A study of nonradiation-bearing sources to the industrial waste line has been completed. Numerous large sources were identified. A study is currently in progress to determine the cost and feasibility of disconnecting those sources from the RLW industrial waste line. When feasibility is established, an action plan will be developed to implement the reductions.

Acid Waste
The volume of acid waste generated increased dramatically in FY03 primarily due to schedule-driven activities in the MOX program. This activity will continue at least until April 2004. Beyond that date, the schedule will become more relaxed and production of acid waste by the MOX project will decrease. In addition, the plumbing of TA-55, PF-4 for increased nitric acid recycle will be complete. How extensively recycled nitric acid will be used remains in question, but it is expected to reduce substantially the quantity of acid waste going to the RLWTF.

Caustic Waste
Caustic waste quantities are expected to increase somewhat due to the 94-1 vault workoff effort. However, research is in progress in NMT to reduce and perhaps replace the current caustic waste process with a process that produces less RLW.

HAZARDOUS/ CHEMICAL WASTE

Forecast and Analysis

The scope of this section includes both hazardous waste and nonhazardous chemical waste.
Hazardous waste is divided into three waste types: RCRA waste, Toxic Substances Control Act (TSCA) waste, and State special solid waste. For the purposes of reporting the waste minimization, LANL distinguishes between routine and nonroutine waste generation. Routine generation results from production, analytical, and/or other R&D laboratory operations; treatment, storage, and disposal operations; and "work for others" or any other periodic and recurring work that is considered to be ongoing. Nonroutine waste is cleanup stabilization waste and relates mostly to the legacy from previous site operations.
The RCRA and 40 CFR 261.3, as adopted by the NMED, define hazardous waste as any solid waste that

- is generally hazardous if not specifically excluded from the regulations as a hazardous waste;

- is listed in the regulations as a hazardous waste;
- exhibits any of the defined characteristics of hazardous waste (i.e., ignitability, corrosivity, reactivity, or toxicity); or
- is a mixture of solid and hazardous waste.

Hazardous waste also includes substances regulated under the TSCA, such as polychlorinated biphenyls (PCBs) and asbestos. Finally, a material is hazardous if it is regulated as a special waste by the State of New Mexico as required by the New Mexico Solid Waste Act of 1990 (State of New Mexico) and defined by the most recent New Mexico Solid Waste Management Regulations, 20NMAC 9.1 (NMED), or current revisions.

Hazardous waste commonly generated at the Laboratory includes many types of laboratory research chemicals, solvents, acids, bases, compressed gases, metals, and other solid waste contaminated with hazardous waste. This waste may include equipment, containers, structures, and other items that are intended for disposal and that are contaminated with hazardous waste (e.g., compressed gas cylinders). Also included are asbestos waste from the abatement program, wastes from the removal of PCB components, contaminated soils, and contaminated wastewaters that cannot be sent to the sanitary wastewater system or wastewater treatment plants.

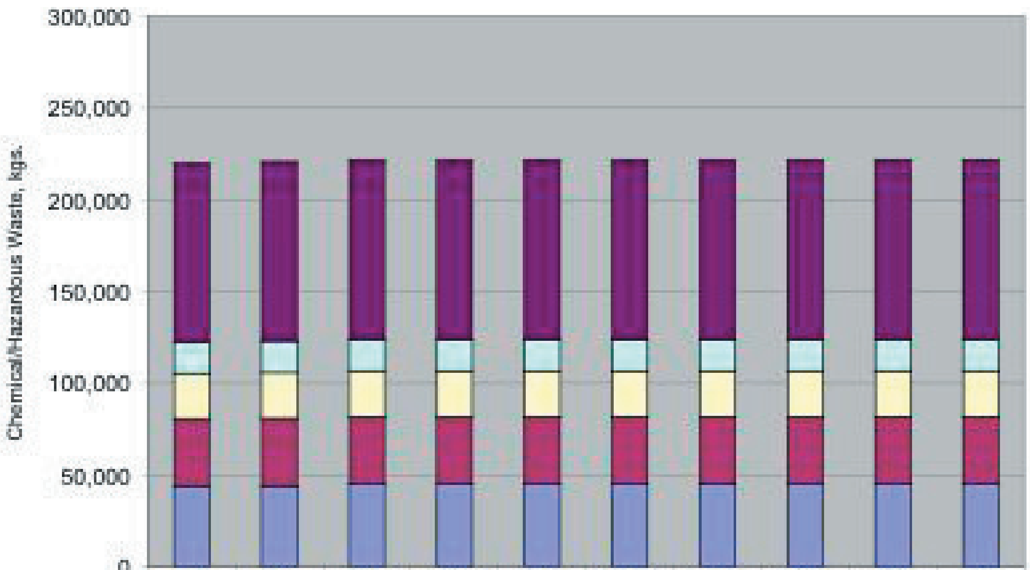
Some hazardous wastes are disposed of through Duratek Federal Services, a Laboratory subcontractor. This company sends waste to permitted treatment, storage, or treatment storage disposal facilities; recyclers; energy recovery facilities for fuel blending or burning for British-thermal-unit recovery; or other licensed vendors (as in the case of mercury recovery). Much of the hazardous waste is shipped by the generators directly off site for disposal.

Nonhazardous chemical waste is chemical waste that is not hazardous waste, as defined above, but which fails to meet the waste acceptance criteria for sanitary landfill burial or sanitary wastewater treatment.

The generation of routine chemical/hazardous waste has been trending downward over the past 10 years. Total chemical/hazardous waste volumes have fluctuated for the past decade primarily because of the strong variation in nonroutine and ER volumes. This strong variation is expected to continue in the future. Because the total chemical/hazardous waste generation is dominated by the bulk waste generated by ER, D&D, and construction activities, it is more informative to discuss bulk and other wastes separately. Bulk wastes are mostly contaminated soils, other chemical/hazardous wastes are lower-volume, higher-risk wastes.

With the exception of FY99, the generation of non-bulk chemical/hazardous waste has been steady over the last few years (back to FY96), and that trend is expected to continue over the next decade. Routine waste has been trending downward, but nonroutine waste is somewhat more variable. However, total chemical/hazardous waste generation has been very volatile and is predicted to remain somewhat volatile over the next 10 years. The activity that will drive the volatility in total chemical/hazardous waste volume is the ER project. As with LLW, the volumes of bulk waste generated by the ER project will be substantial through FY08, with peak activity occurring in FY07. The following chart, Figs. 4=5, presents the predicted chemical/hazardous waste volumes through FY12 by division or program.

Chemical/hazardous waste was previously stored onsite at Area L, TA-54, to await off-site disposal. The Laboratory has taken measures to limit the size of the Area L storage site. The Laboratory has chosen to develop a series of consolidated waste storage facilities where waste can be accumulated for up to 90 days before direct shipment off site for disposal. Currently, four such sites exist at the Laboratory and two more are planned. Over 90% of all chemical/hazardous waste now is shipped directly off site for treatment and disposal, and that fraction is likely to increase in the future. There is no foreseeable impact to Area L from chemical/hazardous waste volume increases. Very large increases in waste volumes could have a small impact on hazardous waste operations at TA-54 in terms of increased record keeping and other administrative efforts. However, a recent reduction in required paper work will minimize the impact on administration.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total, kgs	220,132	221,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000	222,000
Others	97,952	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000
P	16,629	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000
ESH	24,684	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
MST	36,875	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000
ESA	43,992	44,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000

Figure 4-5. Chemical/Hazardous generation forecast

IMPROVEMENT PROJECTS

The following projects were identified as potential corrective measures for the hazardous waste type. These projects are divided into three categories: (1) projects completed in the last year, (2) projects currently funded and ongoing, and (3) proposed projects that are unfunded.

Completed Projects

TA-11 Drop Pad and Tower Improvement . The TA-11 Drop Tower outfall was one of the two remaining HE outfalls at the Laboratory. Wastewater discharged from the TA-11 Drop Tower outfall originated in two ways: explosives testing and storm water. During some explosives tests, HE was scattered onto the ~1-acre (43,560-ft2) curbed pad surrounding the Drop Tower. After such tests, the pad was washed and the water flowed into sumps designed to remove large particles of HE. The water then was discharged into the environment, carrying the small particles of HE. The same outfall was used to discharge storm water collected on the pad. If we assumed an average annual rainfall at LANL of 18 in., the pad collected ~500,000 gal. of storm water per year. The combined storm water and HE-contaminated wash water were discharged to an outfall. The Environmental Protection Agency (EPA) required LANL to the separate storm water from explosives-testing wash water and treat the wash water at the High-Explosives Water Treatment Facility (HEWTF). This project modified the drop pad to allow the waters to be collected and disposed of separately.

Los Alamos Neutron Science Center Experiment (LANSCE) Mercury Shutter Replacement The Manuel Lujan Neutron Scattering Center at LANSCE produces beams of neutrons to study matter on the atomic scale. These neutron beams are arranged around the neutron source in a radial fashion like wheel spokes, and neutrons from the source must pass through channels in the massive steel shield that surrounds the source. Each channel has a shutter embedded in the shield, similar in function to the shutter on a camera, which blocks the flow of neutrons. The neutrons must be blocked before the experimental area can be entered safely. Each shutter uses several hundred pounds of mercury to block the neutron beam. The original shutter system was in place for approximately 25 years. Pressurized helium displaced the mercury into a reservoir to open the shutter. Pressure was released from the system between each opening and closing cycle by venting through a 35-gal. carbon filter. One problem with this open system was that some mercury became trapped in the filter and could not be recovered. A potential problem was that large amounts of mercury in the open system might escape in the event of a catastrophic fire because each of the eight shutters contains between 250 and 1000 lb of mercury. The new closed system eliminates both of these problems. In the event of a fire, heat sensors at the controls of each shutter would cause the beam line to turn off automatically and the mercury to drain safely into storage deep within the shield. Implementing the closed system means that mercury cannot escape into the environment.

DX-2 High-Explosives (HE) Wastewater Case Study The P2 Program is working with DX-2 to address the life cycle of procurement, the use and disposition of materials, processes, and facilities. More information about this work is available in Section 10 on Sustainable Design.

Coolant-Recovery-System Upgrade Materials Science and Technology (MST)-6 personnel designed and built a recovery and recycling system for spent machining fluid in 1998. This project was an extension of a previous upgrade to the existing system that resulted in the upgrade of four additional machines. Upgrading the existing system increased the capacity of the Coolant Recovery System by 50%. Modifications to the system also were made to increase safety and reliability by decreasing the chance and effects of leaks or off-normal situations. The second part of this project was to build a new system to support a collection of four grinding machines. These machines use a slightly different coolant, but a similarly designed system to our existing system allows a reduction of the waste generated from these grinders from six to eight barrels per year to nearly zero.

Pyroclean Oven for Chemistry Division, Actinide Chemistry Group (C-ACT) Organic Synthesis Laboratory. Organic synthesis laboratories generate a large amount of glassware covered with organic residues. Solvents and oxidizing acids are used to clean this glassware, thus generating hazardous waste that requires disposal. Besides the generation of waste, this process is time consuming and expensive. This project purchased and installed a pyroclean (www.tempyrox.com) oven to eliminate the hazardous waste associated with glassware cleaning and to decrease labor expenses. The pyroclean oven uses high temperatures to remove the organic residues; the organic vapors then are destroyed in a catalytic oxidizer system located on the exhaust.

Processing of Pentaerythritol Tetranitrate (PETN) with Supercritical CO2. DX-2 PETN production operations generate 250 gal. of hazardous waste annually. This waste consists of 90 lb of acetone, 226 lb of ethanol, and ~1700 lb of water. Currently, this waste is sent to ESA for destruction at the burn pad. However, NMED has expressed its concerns about the air emissions at the ESA facility. It is uncertain if this disposal path will be available in the future. Without this pathway, DX will have to dispose of this waste as hazardous waste at a cost of $10,000/yr ($6000 in disposal costs and $4000 in waste management costs). Using Advanced Design and Production Technology (ADaPT) funding, DX Division already has developed a process to produce PETN using supercritical carbon dioxide as the solvent, which would completely eliminate the generation of a hazardous waste stream. The purpose of this project is to scale up this process to production levels.

Shipping Surplus Chemicals to University of Texas El Paso Chemistry Department. When the Moly 99 project was terminated, several cartons of commodity chemicals, ammonium hydroxide, sulfuric acid, and hydrochloric acid were left over and unopened in the basement of the Chemistry and Metallurgy Research (Facility) (CMR) Building. The Chemistry Department at the University of

Texas at El Paso (UTEP) graciously agreed to accept ownership of the chemicals if LANL paid for the cost of shipping them ($1200). The cost for UTEP to buy the chemicals would be $6000. Not only does this represent the first R in "recycling, reuse, and reduce," but this also improves the relationship of LANL with a regional university. If the cost of buying the chemicals is used instead of the disposal costs ($300), the return on investment was 400%.

Ongoing Projects

These projects have been funded and currently are being executed. In some cases, the remedies are administrative actions that have been taken to resolve conflicting goals. Hazardous waste reduction projects are funded by the Defense Programs (DP)-funded Pollution Prevention Program, Generator Set-Aside Fee (GSAF) Program, and mission programs.

Mercury Thermometer Replacement, DX-2 . By replacing mercury thermometers with non-mercury thermometers, the chance of a mercury spill is greatly reduced. DX-2, the HE group, uses high-precision thermometers for patent work. In some of their work, they use hydrofluoric acid, which etches the glass on thermometers, potentially causing a mercury spill if a mercury thermometer is used. Half of the thermometers have been replaced. The DX Division Office currently is supplying the funding for replacing the other half of the mercury thermometers in DX-2.

C-ACT Chemical Pharmacy . C-ACT has one of the largest chemical inventories at the Laboratory. Maintenance of large chemical inventories is time consuming and expensive. Large inventories are the result of multiple laboratories located at different areas and the need to maintain a large enough variety of chemicals to respond to different R&D and analytical requests in a timely manner. Currently, individual laboratory owners maintain this large inventory with little coordination between them, which results in duplications within the overall chemical inventory. In addition, without coordination, sharing and reuse of chemicals between laboratory owners does not occur. The net result—the quantity and number of unused, unspent, or surplus chemicals—is increased dramatically. By consolidating the chemical management and procurement into one unified system, duplications and the quantity and number of unused, unspent, or surplus chemicals can be reduced dramatically. C-ACT estimates that consolidation easily will result in a 50% waste reduction. The purpose of this project is to set up a consolidated chemical management/procurement system for C-ACT. If successful, C-ACT will work with division management to expand this system to incorporate all of C Division's chemical management needs. At the completion of this programming, C-ACT will begin to consolidate their chemicals stored in Buildings 24 and 250 at TA-46. A final report will be issued when the consolidation effort occurs.

Aerosolv at TA-54 Can Puncture Unit FWO-SWO has proposed to purchase a can puncture unit to eliminate the disposal of aerosol cans. Staff will be trained to operate the unit on site.

Micro-Scale Chemistry. Currently, the C-ACT organic synthesis team typically performs synthesis activities in macro-scale glassware (25-mL to 2-L scale) reaction apparatus. This project will reduce this scale to 1 mL to 5 mL, which will dramatically reduce the solvent usage. Typical solvents include toluene, methylene chloride, tetrahydrofuran (THF), and ethanol.

Barium Removal Using Ion Exchange at the HEWTF. The HEWTF recently installed an ion exchange unit to remove perchlorate. The need to remove perchlorate is? driven by public concern; it was not a regulatory requirement. As part of the lessons learned from this experience, ESA Weapon Materials and Manufacturing (WMM) reviewed other currently unregulated pollutants discharged from the HEWTF and identified barium as possible future vulnerability. Barium is used in inert explosives formulations and often is present in wastewater treated at the HEWTF. Like perchlorate, the barium levels in wastewater are low. However, also like perchlorate, barium accumulates in the environment. Barium currently does not have surface-water quality standards but has been identified by the EPA and the New Mexico Environment Department as a toxic chemical with published cleanup levels. Rather than await regulation (or adverse public reaction), ESA-WMM wishes to be proactive and add an ion exchange unit that will remove barium and other anions in the wastewater treated at the HEWTF. By removing these contaminants before they are discharged to the environment, ESA-WMM may be able to avoid removing considerable quantities of contaminated soil in the future.

Lead-Free Ammunition. Lead is a persistent bioaccumulative toxic toxin? in the environment. Under the Emergency Planning and Community Right-to-Know Act, Section 313, lead is a toxic-release-inventory (TRI) compound with a 100-lb reporting threshold. Historically, LANL has used lead bullets during training and qualification for KSL security force personnel exercises at the small-arms range. In 2002, due to increased security requirements, KSL released nearly 10,000 lb of lead to the environment from ammunition used at the small-arms range, LANL's largest reportable TRI release to the environment. This lead-free ammunition project will purchase 100,000 rounds of frangible lead-free ammunition to be used for the Glock 22 handguns in training exercises in FY04. KSL personnel will test these bullets against the standard 40 Smith and Wesson bullets to determine if they could be a permanent replacement for the lead bullets used in future training.

Proposed Projects

These projects or actions have been proposed to (1) allow further reduction in the routine hazardous waste stream and (2) improve operational efficiency. Many projects currently are unfunded. If implemented, these projects will provide an additional margin against unexpected and unplanned increases in waste generation.

Identification and Cleanout of Mercury Contaminated Drains. This project is the second phase of a project to identify and clean out drains contaminated with mercury. The first phase was completed in FY01. Based on survey results from September 2001, approximately 9% of the drains at the Laboratory are projected to be contaminated with mercury. The scope of this project is to survey drains throughout the Laboratory, identify those that are contaminated with mercury, effectively clean the contaminated drains, and manage the resulting waste appropriately. Funding is being sought to complete this project.

Cylinder Replacement for Solvent Purification Columns. Synthetic laboratories that perform air-sensitive operations require rigorously??? air- and moisture-free solvents. In the past, solvent purification was achieved using a distillation apparatus consisting entirely of glass that at times is prone to cracks in the glassware and/or leaks at the connecting joints. Furthermore, the agents used to dry the various solvents at refluxing temperatures are themselves highly reactive solids or alloys that are known to combust in air if mishandled. Currently, our group has two sets of advanced solvent purification columns consisting of activated copper and alumina enclosed in stainless-steel cylinders. These cylinders are in turn plumbed with stainless-steel and Teflon™ connections under an inert atmosphere. All parts are Swagelok™ brand and are secured to exact specifications, ensuring that there are no leaks in the system, which itself requires no heating of solvent with minimal exposure to personnel (one system is commercial, whereas the other is built in-house). We hope to improve on this operation through the purchase of Fisher Pak canisters. Once the canisters are empty, they do not require refilling from 4L bottles, as is currently the practice. This new procedure will result in a significant reduction of glass waste in addition to reducing worker and environmental exposure from solvent vapors drastically. Furthermore, this will result in a significant reduction in the hazards associated with peroxide-forming solvents because the solvents always will be kept in an oxygen-free environment. This overall cost includes the cost of 18 canisters and the materials and services/time and effort to retrofit our existing columns.

C-ACT Solvent Reuse. Large-scale organic synthesis requires significant amounts of organic solvents. This project will use a commercially available rotary evaporation system to distill and reuse the solvents used in the organic synthesis process. Typical solvents used are toluene, methylene chloride, THF, and ethanol.

Reduction of Organic Solvent Use for Organic Synthesis and Polymer Characterization. LANL proposes to purchase a high-performance liquid chromatography/gel permeation chromatography (HPLC/GPC) instrument with dual functions, i.e., an instrument that can be used for both purification of the as-synthesized compounds and characterization of the molecular weight of polymers. Two of the vendors (Jasco and Waters) can provide an instrument that operates as both the HPLC and GPC instrument that requires only an additional column and RI detector. This instrument will significantly minimize the generation of organic waste, such as methylene chloride, toluene, and chloroform, by at least 100 L.

Methyl-Ethyl Ketone (MEK) Recycle Plant. The PBX-9501 production process is essential to LANL's stockpile stewardship mission. The process coats an explosive with a plastic binder using an aqueous slurry process. The plastic binder is dissolved in MEK, making a lacquer that is added to the slurry of explosive and water. The solvent is removed by applying heat and pulling a vacuum sweep through the agitation vessel. The water and MEK pulled off by the vacuum sweep are condensed and collected. The PBX 9501 molding powder is dumped and filtered.

The collected condensate and filtrate currently are sent for destruction as a waste. This year, the HE science and W76 LEP programs purchased a distillation unit to separate the MEK and water for reuse in the slurry process, thus eliminating all but the HE waste accumulated on the filter media. The MEK distillation unit is installed at TA-9, Building 48, Bay 103; however, the unit cannot be used in the current configuration because MEK/water waste must be placed in drums, transported to the system, and then fed into the separation unit. This process is not in compliance with current RCRA provisions for waste recycling. This project proposes to integrate the 110-gal. slurry vessel with the MEK distillation plant by installing a hard-piped connection system. The solution being proposed is a closed-loop system with the waste piped from the condensate/filtrate tank to an MEK distillation feed tank. The recycled MEK and water would be stored in their respective product tanks and hard piped back to the slurry plant. Using this recycle system produces PBX-9501 with no aqueous waste and allows water to be recycled continuously. Only small amounts of condensate are lost to the atmosphere during the filtering process; therefore, very little makeup water or MEK will be required.

Precious Metals Recovery by Electrowinning. This project would purchase and set up a commercial electrowinning unit for recovering gold and silver from approximately 100 gal. of cyanide electroplating waste solution. Approximately 2000 g each of gold and silver is expected to be recovered initially. Up to 100 g each of gold and silver per year is expected to be recovered in the forseeable future. An added benefit of electrowinning as a metal recovery method is that it also can destroy cyanide, thus rendering the leftover solution useful as rinsewater for electoplating operations.

SANITARY WASTE

Forecast and Analysis

Forecasting the total weight of sanitary waste generated is difficult. The total mass of sanitary waste depends sensitively on two principal factors: the number of employees (UC and contractors) working onsite at the Laboratory and the rate of recycle of sanitary waste.

The number of on-site personnel has been gradually increasing for the last decade and exceeded 13,000 last year. With the extensive construction planned for the Laboratory the number of on site personnel is likely to increase further. This effect has been largely mitigated in formulating the sanitary waste goals by calculating the goal on a per capita basis. However the resources needed to support further reductions in sanitary waste will increase as total personnel increase.

The rate of recycle of sanitary waste has increased dramatically in the last three years. This is attributable to the awareness programs. Because it is frequently more costly to recycle than to dispose of sanitary waste, this emphasis on recycle has increased the total cost of the sanitary waste operation. . With expected increased growth in personnel, it is unlikely that recycling can keep pace without additional resources.

The protracted continuing resolution in FY03 helped the Laboratory meet and exceed its sanitary waste goals. During the continuing resolution, total weight of sanitary waste picked up fell sharply. This decrease in generation rate is attributable to posponed buying. This is not a normal event and forecasts of total sanitary waste do not include it.

If there is a resurgence in the total weight of sanitary waste picked up or if resources decline, it will be difficult to continue to meet the sanitary waste goals, even on a per capita basis.

Improvement Projects

The projects intended to mitigate the effects of sanitary waste on the environment are shown in the following subsections. The projects are classified as ongoing or unfunded.

Ongoing Projects

The following projects are ongoing.

Material Recovery Facility. The Laboratory completed the construction and began initial operation of an MRF to recover recyclable items from trash dumpsters. Dumpsters are emptied and their contents sorted at the MRF. This operation results in the recovery of ~40% of waste that otherwise would be disposed of. The purchase of a baler has increased the efficiency of the MRF operation greatly.

Cardboard Recycle. For several years, the Laboratory has been expanding its cardboard recycle program. Beginning in FY97, the Laboratory began purchasing roll-offs for facilities across the site. This action has greatly increased the volume of cardboard going to recycle. In addition, the Laboratory began recovering cardboard at the MRF and baling it in FY00, which has improved the ease of recycling. The total amount of cardboard recycled in FY02 was 262 tonnes, which is down from a total of 319 tonnes collected in FY01 due to closure of the MRF for upgrades. It is estimated that ~150 tonnes was collected through the cardboard recycle program, and it is estimated that 112 tonnes was recovered through the MRF.

Paper and Document Recycle. The Laboratory recycles paper, mail, and publications through the following three programs.

- Green Desk-Side Bin Recycle. Most unclassified white paper can be deposited in green desk-side bins for recycle. Sensitive materials are shredded before being recycled as unclassified waste. In FY03, 232 tonnes of white paper was recycled, up from 191 tonnes in FY02.

- MS A1000. Junk mail, books, transparencies, newsprint (newspapers), magazines, flyers, brochures, catalogs, binders, colored paper, and folders are recycled at the Laboratory by sending unwanted materials to MS A1000. Phone books are recycled annually at MS A1000. This program won a White House Closing the Circle Award in FY00. Approximately 182 tonnes of sanitary waste was recycled through the MS A1000 program in FY03, up from 109 tonnes in FY02.

- J568—"Stop Mail." MS A1000 provides a mechanism for recycling unwanted paper or documents, but the “Stop Mail” Program provides a mechanism for stopping unwanted mail from ever entering the mail system. Employees receiving unwanted mail at the Laboratory may send that mail to MS J568 so that their names can be removed from mailing lists.

Construction Debris Inspection/Recycle (Truck Turnaround Program). A program has been implemented to inspect all construction debris for recyclable content. Sorting and segregation of reusable items occur at the construction site before the debris is loaded. Trucks containing construction debris then are dispatched to the salvage yard for inspection. If the trucks are found to contain recyclable or reusable items, those items are removed.

Concrete Crushing. The crushing and reuse program diverted 3115 tonnes of concrete and asphalt. A local small business was used to crush and recycle the concrete and asphalt. The concrete and asphalt recycle system was greatly improved in FY03 through establishment of a staging and recycling area on site. In FY02, these materials were staged at the Los Alamos County landfill. Staging the materials on the Laboratory property saved $92,000 in disposal fees.

Dirt Recycling. All uncontaminated dirt is sent off
site to be used as fill material. Currently, dirt is being sent to the Los Alamos County Golf Course to be used as fill. In FY03, dirt started being staged at Sigma Mesa for reuse on site. In FY03, 2646 tonnes of soil was reused on site or at the golf course.

Brush Recycling. Brush and branches from construction projects are sent to the Los Alamos County Landfill, where they are chipped and distributed as mulch to County residents. In FY03, 100 tonnes of brush was recycled.
Salvage and Reuse. Items that have been replaced or are no longer needed but have some useful life left can be reused within the Laboratory through the Laboratory salvage program or sold to individuals, organizations, or vendors off site for recycling.

Metal Recycle. Metals and scrap wire are recycled through FWO-SWO. All bins are serviced by FWO-SWO, resulting in quicker service and better customer service in FY03. Containers are picked up by the recycler at a centralized staging area. All metal must be clean and suitable for public release (i.e., no radioactive or chemical contamination). In FY03, 1369 tonnes of metal was recycled, up from 807 tonnes in FY02.

Plastic and Aluminum-Can Recycling. Plastic beverage and food containers, aluminum cans, and bulk plastics from Laboratory operations are collected and sent for recycling. This program was initiated in early FY02. In FY02, 24 tonnes of materials was recycled; however, the plastic recycling service provider for bulk plastics no longer is accepting materials. It is estimated that only 5 tonnes of plastic beverage bottles is generated by the Laboratory each year. Recycle options are available for this material. However, this program may be discontinued because of collection costs as compared with the potential for diversion.

Outreach and Education. Recycling pathways have been developed for most waste streams. An education and awareness campaign was initiated in FY03 to ensure that the Laboratory staff is fully utilizing recycling systems that are available to them. It is estimated that up to 200 tonnes of waste was diverted through the expanded use of existing systems.

Paper Use Reduction. An outreach program to encourage the reduction of paper use through double-sided copying and printing will be conducted this year. The pilot will encourage procurement of printers that can print double-sided. Outreach materials and reminders will be distributed to encourage employees to reduce paper use. It is estimated that up to 100 tonnes of paper use will be avoided through this program.

Unfunded Projects and Pilots

These projects have an environmental aspect but currently are unfunded or are being examined.

Sitewide Excess Cleanup. The Laboratory has ~10,000 tonnes of mostly unusable excess equipment stored outdoors. Because this material is exposed to rain and snow, it is polluted significantly with stormwater. In addition, some of the material is flammable and represents a fire hazard if stored near structures or other combustible materials such as grass or trees. The excess material also may serve as a shelter for mice, rats, and other small mammals. An effort to reduce or eliminate this material could reduce the pollution potential dramatically, as well as reduce the fire and health risks. This project may see increased activity in FY04 as a result of Director Nanos's attention to improving housekeeping at the Laboratory.

Composting. Compostable materials include cafeteria food waste and food-contaminated paper or cardboard. Currently, no recycling service providers hold permits for food waste composting. Proposed changes to NMED Solid Waste Management regulations may encourage composting. The Laboratory will monitor the regulatory changes and explore composting options.

Reusable Wood Pallets: Approximately 100 tonnes of pallets comes through the Just In Time (JIT) system annually. A pilot to require JIT vendors to purchase and use reusable pallets will be conducted in FY04. This project was delayed in FY03 because of changes in the Laboratory's business operations systems.

Waste-to-Fuel Conversion Technology. Waste-to-fuel conversion technology has been developed and currently is being piloted. This technology is designed to convert any sanitary waste with British-thermal-unit value into gas that can be used as fuel. The technology produces fuel and minor wastewater and ash waste streams. No air emissions are created. This technology is being piloted in El Paso, Texas.

If viable, waste-to-fuel technology could reduce the sanitary waste stream by up to 1500 tonnes/year. This project can be implemented cost effectively only on a regional basis.

Waste Digester Technology. Digester technology has been deployed at nine sites in the United States. This technology removes organic materials from the sanitary waste stream through a rough digestion process that converts all organic material into compost. The end product is rough compost that can be cured further and used as a soil amendment and as nonorganic materials that are disposed of. The technology allows paper, wood, food, food-contaminated wastes, and cardboard to be processed into compost.

The digester technology, used alone, may reduce the sanitary waste stream by half, or ~1000 tonnes. The digester technology, combined with an active plastic, glass, and metals recycling program, can reduce the sanitary waste stream by 90%. This project can be implemented cost effectively only on a regional basis

AFFIRMATIVE PROCUREMENT

Forecast and Analysis

In FY03, the Laboratory had a 99% rate of affirmative procurement purchases from the online catalog. The Laboratory has sustained this high percentage of affirmative procurement for several years, and the ultimate goal is still 100%. Because not all purchases at the Laboratory are made through the online catalog, the Pollution Prevention (PP) Team currently is examining ways to track affirmative procurement purchases made with credit cards or purchase orders.

ENERGY CONSERVATION

Forecast and Analysis

Energy distribution is managed by Los Alamos County and has two components: Doe energy demand and county energy demand. The total of these two components is important because there is a maximum load serving capacity associated with power lines connecting the County to the Northern New Mexico power grid.

The Laboratory's energy requirements are expected to grow because of the planned addition of energy intensive research facilitites. The county's demand for energy is also expected to grow as the town of Los Alamos grows and as the Research Park grows. Because of these two projected trends, the total demand for electricity is expected to increase by nearly 50% in the next ten years. Such growth will be difficult to accomodate with the existing infrastructure and systems and a number of improvements will need to be made. The expected growth in electrical demand and usage is shown in Table 4- 1 .

Improvement Projects

The following projects were identified as potential measures for improving the energy generation, import, conservation, distribution, and reliability at the Laboratory. These projects are divided into three categories: (1) projects completed in the last year, (2) projects currently funded and ongoing, and (3) unfunded proposed projects.

Completed Projects

These projects have been completed and/or implemented in the last year.

Western Technical Area (WTA) Substation Enhancement. A new substation was put into service at the WTA site. The transformer has a maximum capacity of ~56 MW. The new substation serves to offload the TA-3 substation by providing express feed to the SCC, S Site, and other facilities now served by the TA-3 substation. The new substation also provides redundancy against loss of the TA-3 substation.

Power Plant Motor Control and Emergency Generator Upgrades. The existing power plant motor control center was upgraded, and a new, higher-powered, 1.1-MW emergency power generator was installed.

Stack Gas Recirculation System at the Power Plant. A stack gas recirculation system was added to the power plant. This addition will improve efficiency and reduce the emission of criteria industrial gases.

Additional Turbine Refurbishment. The Laboratory performed a study to establish the cost and feasibility of refurbishing another turbine at the power plant. The 10MW turbine/generator unit is now being refurbished. This will greatly improve its efficiency.

Ongoing Projects

These projects have been funded and currently are being executed.

Chiller Replacement. An increase in efficiency will be realized when the older chillers around the Laboratory are replaced with modern and more efficient chillers. Some of the chillers at TA-3 already have been replaced, and the program will continue in the future. A sitewide chiller upgrade will save up to 1.5 MW of energy.
Conservation. An operational incentive is in place to conserve electricity. As much as 72 to 168 MWh of usage could be avoided by implementing simple conservation measures such as "Energy Star" computing. For that reason, the Laboratory has had a conservation program in place for some time.8-2 Significant savings have been realized as a result of this program. Further savings will be realized, without additional cost, through projects already planned. The LANSCE 201-MHz upgrade will result in a savings of ~1 MW. Although conservation can never solve the peak-demand problem completely, these measures may be a very effective, short-term remedy. A reduction in demand through conservation will mean that near-term growth will not challenge the firm load-serving capability of offsite import and will reduce the frequency of TA-3 power plant operation. The power plant is a particularly inefficient power producer, and its use has been increasing in response to the growth of peak coincidental demand. It may be possible to save as much as 10

MW through combined conservation efforts.

Combustion Turbine Procurement. The Laboratory has begun the process of procuring a 20-MW, simple-cycle, gas-fired turbine for onsite power generation. The Laboratory has received a proposal as a result of a request for proposal (RFP) issued this FY. The project entered Title Two design in FY02, and a turbine is expected to be in place at TA-3, Building 22 in FY04.

Expanded Metering. Numerous meters have been installed at the largest energy consuming facilities, and the meter installation program is continuing. The installation of meters allows better reporting and analysis of energy data.

Proposed Projects

These projects or actions have been proposed to allow further increases in efficiency and reliability. Some currently are unfunded. If implemented, they will provide an additional margin against unexpected and unplanned increases in energy consumption.

Energy Savings Performance Contract (ESPC). Implementation of the DOE Super ESPC Program at the Laboratory has been approved. This will be the Laboratory's main vehicle for improving energy efficiency in existing facilities laboratory-wide. The initial size of the Program will be in the range of $5M-$10M for a wide range of projects. This program will continue for the next ten years and the resulting savings in energy is projected to be $3M per year. Preliminary energy audits are currently being performed on ten facilities.

Alternative Fuel Vehicle Fueling Station. A 1994 executive order states by 2005 federal fleets must be comprised of 75% alternative fuel capable vehicles, using either compressed natural gas or regular fuel. In addition, the alternative fuel usage rate in these alternative fuel capable vehicles must reach 75% by 2005 and 90% by 2010. To satisfy this order, the Risk Reduction and Environmental Stewardship Division bought two fuel tanks with the intention of garnering additional monies to install the fuel tanks and operate a B20 (20% biodiesel and 80% regular fuel) and E-85 (ethanol blended fuel) filling station. Funding has not been identified for the installation process of the project. Currently, only 20% of the Laboratory's fleet is alternative fuel capable.

Continued Chiller Replacement. Chiller replacement is underway for a significant number of chillers at the Laboratory. However, although many sites are candidates for replacement, no funding is available. The replacement of the chillers at LANSCE would have a significant effect on electrical usage, as would the replacement of chillers at TA-48 and the balance of TA-3. Funding has not been identified for these projects. Modern chillers are twice as efficient as the older chillers; thus, the use of modern chillers represents a significant savings.

Annual Demand, MW				Annual Usage, GWh		
DOE FY	DOE	County	Total	DOE	County	Total
2003	69.8	14.6	84.4	400.9	110.8	511.7
2004	71.3	14.6	85.9	414.7	111.8	526.6
2005	74.0	14.8	88.8	427.7	112.9	540.6
2006	77.7	14.9	92.6	437.4	114.1	551.5
2007	80.7	15.0	95.7	450.1	115.7	565.8
2008	83.0	15.1	98.1	457.3	116.6	573.9
2009	85.6	15.2	100.8	465.8	117.9	583.7
2010	89.1	15.2	104.3	485.2	119.1	604.3
2011	92.0	15.3	107.3	498.5	120.4	618.9
2012	96.8	15.4	112.2	534.2	121.6	655.8

Table 4-1 . Electrical energy usage forecast

The existing data and the volatile nature of energy consumption at the Laboratory do not allow reliable comparison of FY05 projected consumption with and without conservation project implementation. However, the implementation of the above projects will reduce peak demand by a minimum of 21

MW.

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WATER CONSERVATION

Forecast and Analysis

Water consumption at the Laboratory is difficult to project because of the lack of quality data. Before FY98 the data on Laboratory water usage was estimated from well production and county consumption. This estimate was known to be inaccurate because there were other users not accounted for in the estimate (e.g. Bandalier National Monument and the Forest Service). After FY98 when DOE ceded half its water rights to Los Alamos County and turned water distribution over to them, estimates of total Laboratory water usage improved . However, complete definition of water use at the Laboratory is not possible because of the very incomplete metering system. At the Laboratory only large users of water have meters. Since there is very incomplete definition of where water is being used, and hence what factors are influencing its use, it is difficult to accurately predict future consumption.

Since the largest user of water are the large cooling towers, water consumption should correlate well with energy consumption. However, comparison of the monthly water and energy usage charts for the past three years show virtually no correlation. between water usage and either peak electrical demand or total energy consumption. Further, between FY99 and FY02 water usage dropped continuously while electrical consumption increased in each of those years except FY01.

The trend in water consumption and the lack of correlation to energy consumption may be explained by aggressive water conservation projects. It is possible that water use efficiency iimprovements have outpaced growth in energy usage. However, if energy consumption continues to grow it will eventually catch up with and surpass water efficiency improvements. Indeed, it may have already done so. Water usage at the Laboratory rose in FY03 for the first time in five years.

In the absence of quality data it is not possible to forecast future water use and no forecast is presented here. Under such uncertainty, prudence dictates the continued implementation of water conservation measures. The following section describes recently completed, ongoing and proposed improvement projects.

Improvement Projects

Several measures could be implemented to reduce the quantities of water used, extend the life of the aquifer, and reduce the environmental impact from water use. These projects, which are intended to reduce water consumption and increase the efficiency of use, are classified as completed or ongoing.

Completed Projects

LANSCE Cooling-Tower Control System Upgrades. LANSCE has three large cooling towers [two supporting LANSCE and one supporting the Low-Energy Demonstration Accelerator (LEDA)]. These towers operated at one to two cycles of concentration using ~110 million gallons of potable water yearly. Because this facility is geographically distant from the CTWC Project, it will not have access to the treated sanitary wastewater that would allow it to increase to 10 cycles of concentration. However, the LANSCE cooling towers have increased their cycles through better control systems. In FY02, facility personnel installed control systems on the three cooling towers to achieve three cycles of concentration. This water conservation initiative will save 33 to

50 million gallons of potable water annually.

Upgrades to the Cooling-Tower Operations and Maintenance Manual and the Los Alamos National Laboratory Engineering Manual. The evaluation of the small-cooling-tower control systems at TA-35 and TA-48 helped determine which control systems were appropriate for the differently sized towers. The Pollution Prevention (PP) Office and FWO distributed this information throughout the Laboratory via the Cooling-Tower Operations and Maintenance Manual and the Los Alamos National Laboratory Engineering Manual. These two manuals require implementation of cooling-tower upgrades for all new cooling systems and for all large maintenance upgrades.

Ongoing and New FY03 Projects

Small-Cooling-Tower Upgrades Throughout the Site. The PP Office has funded cooling-tower control system upgrades for TA-35 and TA-48. The upgrades have been completed for TA-35. More than 30 other small cooling towers at the Laboratory must be assessed and upgraded to increase water efficiencies. Implementing the new requirements in the Cooling-Tower Operation and Maintenance Manual and the Engineering Manual will be a step toward implementing these upgrades.

Waterless Urinals Project. This project will pilot the use of waterless urinals for new construction and retrofit projects at the Laboratory. The pilot will be conducted at TA-16-901 and -946. Retrofitting existing urinals with waterless models will save more than 31,000 gal. of water per year. Additional interest has been generated in installing other units within the Laboratory. A request has been made to install some units in the Administration Building. This project has raised additional issues regarding plumbing code compliance. FWO is recommending that no additional units be installed until a study is made. FWO-Design Engineering & Construction Services (DECS) is proposing to revise the LANL design standards to include installation of waterless urinals.

Leak Detection Project. FWO/UI is funding a project to better detect leaks in water lines. A contractor will be conducting leak detection and pinpointing surveys on water mains throughout the Laboratory. The contractor will be performing a water system audit and, based on the findings, providing a cost-effective recommendation for corrective action. Flow meters will be used to monitor flows, and electrosonic and advanced correlation instruments will be used to detect and pinpoint underground leaks. By using this type of advanced technology, millions of gallons of water can be saved each month.

Survey and Repair Leaks in the Piping in the Water Drainage System. The Laboratory has conducted camera inspections of the 50 miles of its sewer lines and has concluded that as much as 25% of the lines may be subject to leakage. No measurements have been taken to date of the losses to leakage from the sewer system.

CTWC Project. The CTWC Project, funded by the Infrastructure, Facilities, and Construction Office, was initiated to seek the best commercial technologies for improving cooling-tower-water use. The Laboratory issued a Request for Proposal (RFP) to industry to pilot water conservation technologies on large-scale cooling towers with both potable and treated sanitary wastewater. The pilot phase is complete, and the results have been evaluated. The Laboratory will construct a building containing water filtration/treatment process equipment. This equipment will remove particulates from treated sanitary wastewater in the sewage treatment plant at TA-46 for reuse in cooling towers at TA-3. The plant is expected to be on line in FY03. Phase I of the project will supply filtered water to the Nicholas Metropolis Center.

SUSTAINABLE DESIGN

In July of 2003, the UC Board of Regents adopted a policy for green buildings and clean energy standards. The UC will be required to create an internal certification process based on the Leadership in Energy and Environmental Design (LEED)standard, which evaluates the environmental sustainability of buildings. Significant renovations of existing buildings also will be required to apply sustainability principles. The UC also will develop a strategic plan for implementing energy efficiency projects for existing buildings and infrastructure to reduce systemwide nonrenewable energy consumption, with an initial goal of reducing energy consumption by 10% or more by 2014.

Improvement Projects

In fiscal-year (FY)02 and FY03, LANL began to assess opportunities for sustainable design implemention. Currently, nine strategic facility plans are in progress at LANL. For FY04, a coalition of LANL organizations has proposed a systematic approach to new construction to ensure the maximum return to the Laboratory in terms of life-cycle facility costs, environmental impact, resources consumption, and, most importantly, staff productivity.

Completed Projects

Sustainable Design Guide Project Management Division's Site and Project Planning group (PM-1) provides institutional land use and facilities planning services to support Laboratory programs and divisions. The group's planning capabilities support long-range facility planning issues and transition to the development of new projects. The LANL Sustainable Design Guide presents a specific planning and design process for creating and meeting LANL sustainability goals, including energy reduction, indoor environmental quality, water quality, and site preservation; guiding the planners, designers, contractors, and groups responsible for the physical development of the Laboratory; providing a tangible process for evaluating progress toward sustainability in the long-range physical development of the Laboratory; and providing leadership to the DOE laboratory system, as well as to the nation, for maintaining energy security and economic growth through sustainable design principles and practices.

Chapter 5: Prevention Accomplishments

Accomplishments

The Pollution Prevention Program conducts two major programs designed to eliminate priority waste streams and promote waste minimization practices at the Division, Group and individual level. The first is the Generator Set-Aside Fee (GSAF) program, which funds research, development and demonstration of new approaches to waste minimization. These are year long-projects, selected by peer-review and conducted by the Laboratory organization that owns the problem waste stream. The P2 Awards program is an annual competition to select team and individual projects that have done the most to minimize waste during the year. The proposals are peer-reviewed. Senior Management presents the awards at an annual ceremony along with a small cash award. The return-on-investment for this program last year was approximately 450:1.

1. During FY03, P2 awards were given to approximately 200 people who completed 46 pollution prevention projects either individually or working in teams. 20 different Laboratory Divisions and subcontractors were represented at the awards ceremony. Pollution costs avoided thanks to the projects completed this year are estimated at over $4 million.

2. Since 1993, sanitary waste generation at the Laboratory has decreased by 34%, low-level waste generation has decreased by 82%, mixed low-level waste generation has decreased by 63%, and hazardous waste generation has decreased by 95%.

3. The perchlorate analysis resulted in an extremely successful cross-laboratory evaluation of perchlorate generation and options presented to the NMED, public and DOE. As a result of this project, all discharges

of perchlorate to the environmental were eliminated.

4. In May 2003, a reusable containment tent was used for the first time in a building PF-4 at Technical Area 55 to prevent any contamination from spreading while a furnace was being removed from a glove box. Reusable tents provide many advantages over the old wood and plastic tents that had to be constructed on-site. The benefits include reduced labor, superior containment of contamination, reduced low-level waste generation, less disruption of normal activities in the surrounding area, and decreased fire risk. The Nuclear Materials Technology Division (NMT) has mandated that reusable contamination control tents be used exclusively in the future. An estimated 10 cubic meters of routine LLW was avoided.

5. The Management Walkaround Cards for pollution prevention were revised and updated to include office and laboratory space.

6. The Sanitary Waste Goal for 2005 was re-negotiated with DOE-LASO. The Laboratory agreed to achieve and maintain a 50% reduction in sanitary waste by 2005, based on per capita waste generation.

7. Numerous projects were initiated for sustainable building design. Leadership in Energy and Environmental Design (LEED) criteria evaluations were completed for two new buildings. A case study, "Waste Minimization or Elimination Through Sustainable Building Design: The Characterization of High Energetic Materials (CHEM) Laboratory Building," was completed. A workshop on sustainable design was held in December 2002. A strategic plan has been developed for FY04.

8. A case study was completed for "Hazardous Waste Chemicals Elimination at Los Alamos National Laboratory."

9. In June 2003, the first shipment of commodity chemicals, ammonium hydroxide, sulfuric acid, and hydrochloric acid were transferred from the basement of the CMR Building to the Chemistry Department at the University of Texas at El Paso, as part of a Generator Set-Aside Fee Project.

10. Green Zia applications were made by NMT, ESA, DX and FWO divisions in 2003. The P2 program employed a feedback system to take results of division applications and use for continuous quality improvement. Action plans were developed for FY04 for review by Divisions' managers.

Awards

The Pollution Prevention Program participates in two major annual award programs. These programs are the Generator Set-Aside Fee (GSAF) program and the P2 Awards program.

GSAF Awards

The Generator Set Aside Fee (GSAF) Program is a Department of Energy (DOE) mandated program that collects a small fee from waste generators, based on the quantity of waste generated, and invests the collected funds on projects to reduce waste or pollution. Projects are prioritized and recommended by the Laboratory's Pollution Prevention Council. The Prevention Program Office attempts to find funding from alternate sources for those proposals that are not chosen for GSAF funding. Not only does the fund help to implement waste-minimization projects, but the tax itself acts as an incentive for groups to reduce waste generation as much as possible.

In FY03 a new GSAF selection methodology was adopted. The proposals were peer reviewed and prioritized based on waste category, the amount of waste that could be avoided and the potential return on investment. The following wastes categories are ranked in order of priority:

- No Path Forward Waste
- Some MLLW (radioactive Hg for example)
- Non-DP TRU Waste (primarily Pu238 waste)
- TRU/MTRU
- Mixed LLW (MLLW)
- TRI Chemical Use Reduction
- Solid LLW Non-Compactable
- Solid LLW Compactable
- Hazardous Waste
- Green Is Clean
- New Mexico Special Wastes
- Sanitary Waste

In 2004 the Laboratory chose twelve projects to receive funding from the Generator Set-Aside Fee (GSAF) fund. Over $500,000 was awarded this fiscal year to projects designed to reduce future waste generation. The winning projects are described below.

Recycling of Lead from RCAs, Loren Abercrombie, FMU-1. This project will divert 30,000 kg of lead from the mixed low-level waste stream. This is a routine waste stream that if disposed of would count against the FY05 DOE Pollution Prevention goal for mixed low-level waste. At ORO the material is reused in its existing form or is processed to make shielding or other shapes needed by DOE and other **federal** agencies.

Contaminated Lead/Scrap Metal Abatement, Julie Minton-Hughes, FWO-SWO.
The scope of the project will be to dispose of unwanted radioactive contaminated lead bricks, lead pigs, and shipping containers. The collected items will be packaged according to DOT 49 CFR regulations and ship the material to Duratek Federal Services, Bear Creek Operations, Oak Ridge TN. Duratek will process the contaminated lead and scrap metal and will reuse the material in new shielding containers which will be reused through the DOE Complex.

Solvent Reuse, Tom Robison, C-ACT. Large scale organic synthesis requires significant amounts of organic solvents. This project will use a commercially available rotary evaporation system to distill and reuse the solvents used in the organic synthesis process. Typical solvents used are toluene, methylene chloride, THF, and ethanol.

Barium Removal Using Ion Exchange at the HEWTF, David Hayden, ESA-WMM. The (High Explosives astewater Treatment Facility (HEWTF) recently installed ion exchange unit to remove perchlorate. The need to remove perchlorate driven by public concern; it was not a regulatory requirement. As part of the lessons learned from this experience, ESA-WMM reviewed other currently unregulated pollutants discharged from the HEWTF and identified barium as possible future vulnerability. Barium is used in inert explosives formulations and is often present in wastewater treated at the HEWTF. Like perchlorate, the barium levels in wastewater are low. However, also like perchlorate, barium accumulates in the environment. Barium does not currently have surface water quality standards but has been identified by the Environmental Protection Agency and the New Mexico Environment Division as a toxic chemical with published cleanup levels. Rather than await regulation (or adverse public reaction), ESA-WMM wishes to be proactive and add an ion exchange unit that will remove barium and other anions in the wastewater treated at the HEWTF. By removing these contaminants before they are discharged to the environment, ESA-WMM may be able to avoid having to remove considerable quantities of contaminated soil in the future.

Implementation of Compaction/Granulation Technology at TA-55, Susan Ramsey/Don Quintana, NMT-7/ESA-AET. The Compaction/Granulation Technology was identified to address the transuranic (TRU) combustible waste streams at TA-55. Combustible waste comprises approximately 28% of the waste streams from TA-55 operations and it includes plastic bottles, tygon tubings, and bag-out bags. The compactor/granulator will be used for compacting and shredding combustible waste streams to achieve higher density packaging. The Compaction/Granulation Technology will yield up to an 80% reduction in waste volume and could result in significant volume reduction of combustible waste stream destined to WIPP. Furthermore, the deployment of this technology will allow significant progress towards the mandated 2005 goals as defined in the DOE/UC contract.

RLWTF, Sherry Evans-Carmichael/Robert Dodge, NMT-7. Currently, the Waste Inventory Tracking System (WITS) at NMT Division provides a comprehensive electronic cradle-to-grave waste management tracking system that includes multiple waste types, such as compactible waste, non-compactible waste, oversized waste, mixed waste (RAD and Hazardous waste), hazardous and chemical waste, universal waste, New Mexico Special Waste, and wastes containing asbestos and polychlorinated biphenyls (PCBs).

Two important assets of WITS are the flexible architecture of the program to accommodate future changes and the availability of information on waste generation and waste characteristics in electronic form. NMT-7 will expand WITS to include a piped liquid waste module to more effectively track NMT liquid wastes piped to the Radioactive Liquid Waste Treatment Facility (RLWTF or TA-50) and the Sanitary Wastewater Systems Consolidation (SWSC). The piped liquid waste module will address the TA-55 Acid and Caustic Waste Lines first, and later the Industrial Wastes Lines for both TA-55 and the CMR facility.

Oil-free vacuum pumps at LANSCE Lujan Target, James Knudson, LANSCE-7. Operation of the target at the Lujan Neutron Scattering Center produces spallation products which can become trapped in the oil of the vacuum pumps that evacuate the vessel that contains the target. The vacuum load on the pumps is such that the pump oil must be changed every month with expensive oil designed for high-throughput situations such as this. The pumps presently used have an oil capacity of 17 liters; oil changes involve an additional quantity of oil in order to flush the pump mechanism. This project will replace the two existing Alcatel model 2063 vacuum pumps with two Alcatel model ADP-122P dry vacuum pumps.

Lead-Free Ammunition, Steve Rivera/Margie Stockton, PTLA/RRES-MAQ. Lead is a persistent bioaccumulative toxic in the environment. Under EPCRA Section 313 lead is a TRI compound with a 100 pound reporting threshold. Historically LANL has used lead bullets during training and qualification for PTLA security force personnel exercises at the small arms range. In 2002, due to increased security requirements PTLA released nearly 10,000 pounds of lead to the environment from ammunition used at the small arms range. This is LANL's largest reportable TRI release to the environment.

Lead-free, "frangible" ammunition is available on the market and is used at other DOE sites for training purposes. At the new Live Fire Shoot House at LANL's small arms range only frangible, lead-free bullets are used. However, for the more traditional, outside target shooting PTLA has continued to use lead bullets, primarily due to cost. The frangible, lead-free bullets cost approximately twice that of conventional lead bullets. There have been notable technical improvements in the manufacture of lead-free ammunition in recent years and PTLA is eager to test these new bullets in training exercises.

The Glock 22 semi-automatic handgun is the most widely used gun with the security force. In 2002, 334,667 rounds of 40 S&W bullets were fired, resulting in 7,296 pounds of lead released to the environment. The cost for the 40 S&W standard bullets is approximately $170/thousand. Ammunition manufacturers now offer a frangible, lead-free equivalent bullet that costs approximately $300/thousand. This project will purchase 100,000 rounds of frangible lead-free ammunition to use in training exercises in FY04 in the Glock 22 handguns.

Cable Stripper for DU Contaminated Firing Site Cables, Jerry Vasilik/ Connie Gerth, DX-4. Cables are used at DX division firing sites to connect explosives with detonation devices, instrumentation and diagnostic equipment in support of research, development, and testing operations. The cables are plastic coated copper and aluminum. When used at DU and/or beryllium contaminated firing sites, these cables become low-level waste if contaminated. Under current LANL guidelines the cables become administratively controlled waste if not contaminated because they originate in RCAs. The cables cannot be trimmed and refitted for re-use by DX-1 at their facilities due to DU and potential beryllium contamination. New LANL guidelines implementing the DOE moratorium on recycling metal from RCAs have been proposed. Under these guidelines metal removed from DX firing sites controlled for DU shrapnel would be eligible for recycling if it met release requirements. Typically, cables have surface contamination only on the plastic coating, not volume contamination of the metal itself. DX division will investigate the use of a cable/wire stripper to remove DU contaminated plastic coating from the exterior of these cables to make them eligible for recycling. If the preliminary investigation indicates that a cable stripper is practical for this application, additional funding will be requested to purchase a cable stripper, install it, and train operators in its use.

The stripped plastic coating would be disposed as either low-level waste if DU contaminated, administratively controlled waste if beryllium contaminated, or solid waste if free from both DU and Be contamination. clean metal would be recycled under new LANL guidelines. Current annual low-level waste volume is approximately 50 cubic yards. Projected annual low-level waste volume of stripped plastic coating is 5 cubic yards.

PF-4 Blower and Vacuum Cleaner Pre-Filters, Kevin Barbour/Julio Castro, HSR-1/RRES-PP. Blowers and vacuum cleaners are used in PF-4 to perform various activities. These activities include glove change, providing negative-pressure to contamination tents and to clean floors. Each blower and vacuum cleaner in use at TA-55 has an internal filter, that captures radioactive particulates while in the unit is operating. Because the blowers and vacuum cleaners must be opened to access and to remove particulates that have accumulated on the internal filter, NMT has avoided opening them to avoid exposing workers to additional radioactive contamination. Therefore, once the internal filter becomes blocked, the entire unit, including the body and hose are placed in a 55-gallon drum and disposed of as non-compactible transuranic (TRU) waste. Each blower is approximately 4 cubic feet (.11 cubic meter), and each vacuum cleaner is 4.4 cubic feet (.13 cubic meters). Historically, as many as 10 blowers and 12 vacuum cleaners have been used and disposed of each year within PF-4, resulting in as much as 2.7 cubic meters of TRU waste. It is expected that the volume of blowers to be disposed will increase in the foreseeable future due to additional TRU waste packaging activities.

The HSR-1 staff has designed and constructed cardboard secondary prototypes for a HEPA filter system to pre-filter the air before it enters the blower, eliminating the need to dispose of these blowers and vacuum cleaners once their filter becomes blocked. HSR-1 has also designed and fabricated a prototype HEPA filter assembly for the vacuum cleaners that is smaller than that for the blowers. Both filter assemblies are composed of a DOP tested HEPA filter, a stainless steel housing, and a hose. The filter assembly for the vacuum cleaner needs a stainless steel adapter to connect the hose. The blower and vacuum filter assemblies are designed so that they can be removed without exposing workers to the radioactive particulate. Each filter assembly will be removed when it becomes loaded, and can be placed in a 15-gallon (.06 cubic meter) can for disposal.

This project will fabricate 8 blower HEPA filter assemblies and 8 vacuum cleaner HEPA filter assemblies. Molds for the blower and vacuum cleaner housings must be made to mass produce them. The housing molds can be used indefinitly.

Re-engineering of the Non-Compactable Low-Level Waste Stream Management Process, Dave Fink /Charles Bonner/ Joe Gonzales, NMT-14/ NMT-4/ NMT-7. Each year NMT-Division facilities produce approximately three thousand (3000) 1′ x

1' x 2' cardboard boxes of Compactible Low-Level Waste. This waste is primarily room trash consisting of surgeon's gloves, paper, plastic, etc. The cardboard box alone adds approximately 1.54lbs of combustible waste to the waste stream per box and is a major constituent of the waste stream. The cardboard boxes alone, without the combustibles are approximately 4600lbs. Although several efforts are underway to reduce the source of this waste stream, little effort has been given to reducing the packaging material, time, resources, and personnel exposure currently required to manage this waste stream. Currently four different Groups from three different Divisions, follow a 25-step process to manage Compactible LLW. During that process the waste containers are touched 11 different times. Despite their small size, each container is Swiped, Surveyed, Assayed, Inspected, and shipped as individual containers.

This proposal will re-engineer the Compactible LLW management process from the point of generation through disposal. It will reduce the volume of the waste stream by eliminating the cardboard boxes, reduce the amount of plastic in the waste stream, and reduce the amount of energy used to inspect, assay and transport this waste. A team of SMEs from NMT-4, NMT-14, NMT-7, S-4 has already met to discuss the technical feasible of managing this waste stream in a vastly improved manner. NMT proposes to shift from the cardboard boxes to a flame resistant vinyl bag to serve as the primary container for combustible waste. These primary containers (heavy flame resistant vinyl bags) would be supported within steel carts that have fusible links on their lids.

A measurable waste reduction of 11 cubic meters will be achieved just from the elimination of the cardboard boxes. Another environmental benefit will be the reduction in the amount of electricity used to count the smears, RTR, and assay the individual boxes and the amount of fuel used to transport the containers. Reducing the packing and the number of times these containers are touched will result in more cost-efficient operations.

Development of Bench-Scale Molten Salt Oxidation Processes for Treating Pu-238 Contaminated Combustible Waste, M. Lynn Remerowski, NMT-9. Pu-238 is used to heat and power components needed for deep space missions. Pu-238 is no longer produced domestically, making it a limited resource, which is now also in greater demand for applications of national interest. Concomitantly, because it is highly thermally active (0.56 W/g Pu-238) and radioactive (17.1 Ci/g Pu-238), disposal options for Pu-238 contaminated combustible materials are presently limited as it is classed as a no-path-forward waste. Recovery of Pu-238 from contaminated waste is clearly the best solution to meet both waste minimization and efficient production goals. Pyrolyzed ash from cheesecloth is the best residue for Pu-238 recovery because it contains up to 10%wt Pu-238. Other combustible waste stream candidates for recycle are graphite, plastics, organic liquid, and ion exchange resin.
Molten salt oxidation (MSO) technology has been shown to successfully treat radioactive contaminated combustibles (liquid and solid). This project will teat options and resolve issues so that this technology can be deployed at full scale.

To learn more about the GSAF program at the Laboratory, and the projects that received funding this year and in the past please visit the website at: http://emeso.lanl.gov/eso_projects/set_aside/gsaf.html.

P2 Awards Program

The P2 award progam recognizes outstanding pollution prevention efforts at the Laboratory. These annual rewards are made on Earth Day, which fell on May 7 this year. Individuals or teams are nominated for the awards by their peers and are selected on the basis of their contribution to waste minimization and pollution prevention at the Laboratory. Those selected receive a small monetary award. Representatives of Laboratory senior management make the awards.

This year 46 awards were made and are listed below.

1. Recycling and Reuse
2. ESA PCB Equipment Replacement Project
3. Otowi Energy Savings Retrofit Project
4. Green ZIA Commitment Recognition- LANSCE Division
5. Lujan Waste Sorting & Segregation Project - A Lesson in Inventory Control and Packaging Efficiency
6. TA-55 Paint Stripper
7. Binder Ignition Oven
8. Flue Gas Recicrculation
9. Frac-Tag and Pine Needles
10. MIOX Unit Refits
11. SWS Blower Refits
12. SWS Facility: Computerization of Records: New and Old
13. TA-21 Steam Plant Blowdown
14. Elimination of an Environmental Liability- oil from the LSND Neutrino Project
15. Nochar Acid Bond A-660
16. Caustic Stripper Solution Reuse at the TA-50 RLWTF
17. Aquifer Testing at Municipal Supply Well
18. Quick Look Storage Tank Survey Team
19. Perchlorate Reduction at TA-50 RLWTF
20. Traffic Signal Power Reduction
21. Purification of Aqueous Plutonium Chloride Solutions Via Precipitation and Washing
22. TA-16 300 Demolition Project
23. Waterless Urinals
24. SWO Materials Recycling Facility-LANL wide Recycling Activities
25. DX-2 Mercury Thermometer Replacement
26. Sustainable Design of the Emergency Operations Center
27. Decontamination and Decommissioning of TA-41, building 4S, 16, 30 and 53
28. P2 Improvements to LANL Engineering Standards
29. Nitrate Waste Treatment Facility at RC-45
30. Waste Reduction Through Awareness and Training
31. Reuse of TA-55 Leaded Windows
32. Reuse of TA-55 Heliarc Welders at CMR
33. NPDES Outfall Dechlorinators Installation at NMT Division
34. Use of Non-Hazardous Recyclable Oils
35. TA-55 TRU Waste Facility Improvements
36. TA-55 TRU Waste Process Improvements
37. Beryllium contamination Controls on the PF-4-343 Lathe
38. Reuse of TA-55 Neutron Shielding Materials at CMR
39. pH Measurement of TEA in TCE
40. Volume Reduction by absorbent Substitution
41. Preconstruction Planning for Recycling
42. Beneficial Use Versus Salvage of Glovebox
43. LANSCE Radioactive Air Emissions Reduction
44. Bromobenzene Reuse Initiative
45. Volume Reduction of Treated Mixed Waste
46. Household Hazardous Waste Collection Days at San Juan and Pojoaque Pueblos

A complete description of the award projects can be found at http://emeso.lanl.gov/eso_projects/p2_awards/winners_2003.htm.

Acronyms & Abbreviations

A/E	Architect/Engineer
AF	Acre Feet
AFV	Alternate Fuel Vehicle
AFY	Acre Feet per Year
AHF	Advanced Hydrotest Facility
B	Bioscience (Division)
BRC	Below Regulatory Concern
BUS	Business Operations (Division)
C	Chemistry (Division)
C-ACS	The Analytical Chemistry Sciences Group
CCF	Central Computing Facility
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
C-INC	Isotope and Nuclear Chemistry Group in the

	Chemistry Division
CMIP	Capability Maintenance and Improvement Project
CMR	Chemistry and Metallurgy Research (Facility)
CNMIP	Colorado/New Mexico Intertie Project
COD	Chemical Oxygen Demand
County	Los Alamos County
	County Landfill (The DOE-Owned, Los-Alamos-County-Operated Landfill)
CRT	Cathode Ray Tube
CTWC	Cooling Tower Water Conservation
CY	Calendar Year
D&D	Decontamination and Decommissioning
DAHRT	Dual Axis Hydrodynamic Test
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOE/DP	Department of Energy/ Defense Programs
DOE/EH	DOE Office of Environment, Safety, and Health
DOE/EM	Department of Energy/ Environmental Management
DOT	Department of Transportation
DP	Defense Programs
DSSI	Diversified Scientific Services, Inc.
DU	Depleted Uranium
DVRS	Decontamination and Volume Reduction System
DX	Dynamic Experimentation (Division)
EM	Environmental Management
EMS	Environmental Management System
EO	Executive Order
EPA	Environmental Protection Agency
ER	Environmental Restoration
ER/D&D	Environmental Restoration/ Decontamination and Decommissioning
ESA	Engineering Sciences and Applications (Division)
ESH	Environment, Safety, and Health (Division)
FFCO/STP	Federal Facility Compliance Order/Site Treatment Plan
FWO	Facility and Waste Operations (Division)
FWO/UI	Facility and Waste Operations Utilities and Infrastructure Group
FY	Fiscal Year
GDMS	Gas Discharge Mass Spectrometer
GET	General Employee Training
GIC	Green Is Clean
GPMS	Glove Procurement Management System
GPP	General Plant Project
GSA	General Services Administration
GSAF	Generator Set-Aside Fee
GW	Ground Water
GWCP	Generator Waste Certification Program
HE	High Explosives
HEPA	High-Efficiency Particulate Air Filter
HLW	High-Level Waste
ICP	Inductively Coupled Plasma
IM	Information Management (Division)
INEEL	Idaho National Energy and Environmental Laboratory
ISM	Integrated Safety Management
ISM-E	Environmental Component of ISM
ISO	International Standards Organization
JIT	Just In Time
Laboratory	Los Alamos National Laboratory
Landfill	The DOE-Owned, Los-Alamos-County-Operated

Landfill
LANL Los Alamos National Laboratory or the Laboratory
LANSCE Los Alamos Neutron Science Center Experiment, or Los Alamos Neutron Science Center (Division)
LAPP Los Alamos Power Pool
LDCC Laboratory Data Communications Center
LEDA Low-Energy Demonstration Accelerator
LEED™ Leadership in Energy and Environmental Design
LINAC Linear Accelerator
LIR Laboratory Implementation Requirement
LLNL Lawrence Livermore National Laboratory
LLW Low-Level (Radioactive) Waste
LPR Laboratory Performance Requirement
LRS Laramie River Station
MBA Material Balance Area
MDA Materials Disposition Area
MEO Mediated Electrochemical Oxidation
MLLW Mixed Low-Level Waste
MRF Material Recycle Facility
MST Materials Science and Technology (Division)
MT Metric Ton
MTRU Mixed Transuranic
MW Megawatt
NARS Nitric Acid Recovery System
NDA Nondestructive Assay
NIS Nonproliferation And International Security (Division)
NMED New Mexico Environment Department
NMSWMR New Mexico Solid Waste Management Regulations
NMT Nuclear Materials Technology (Division)
NPDES National Pollutant Discharge Elimination System
NRC Nuclear Regulatory Commission
ODS Ozone-Depleting Substances
P2/E2 Pollution Prevention and Energy Efficiency
PCB Polychlorinated Biphenyl
PEP Project Execution Plan
PM Project Management (Division)
PNM Public Service Company of New Mexico
PNMGS Public Service Company of New Mexico Gas Services
PNNL Pacific Northwest National Laboratory
PP Pollution Prevention Office
PPE Personnel Protective Equipment
PVA Polyvinyl Alcohol
PVC Polyvinyl Chloride
R&D Research and Development
RANT Radioassay and Nondestructive Testing
RCA Radiological Control Area
RCRA Resource Conservation and Recovery Act
RFP Request for Proposal
RLWTF Radioactive Liquid Waste Treatment Facility
RRES Risk Reduction and Environmental Stewardship (Division)
RRES-AT Applied Technologies Group of RRES Division
RRES-ECO Ecology Group of RRES Division
RRES-ER Environmental Restoration Group of RRES Division
RRES-MAQ Meteorology and Air Quality Group of RRES Division
RRES-SA Science Applications Group of RRES Division
RRES-SWRC Solid Waste Regulatory Compliance Group of RRES Division

RRES-WQH	Water Quality and Hydrology Group of RRES Division
SAR	Safety and Analysis Report
SCC	Strategic Computing Complex
SD	Sustainable Design
SNM	Special Nuclear Material
SPP	Storage Photostimulable Phosphor
STL	Safeguards Termination Limit
STP	Site Treatment Plan
SWB	Standard Waste Box
SWEIS	Sitewide Environmental Impact Statement
SWO	Solid Waste Operation
SWS	Sanitary Wastewater System
TA	Technical Area
TBD	To Be Determined
TCE	Trichloroethylene
TCLP	Toxic Characteristic Leaching Procedure
TFCH	Treated Formerly Characteristic Hazardous (Waste)
TRI	Toxic Release Inventory
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
UC	University of California
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WAPA	Western Area Power Administration
WCRRF	Waste Compaction, Reduction, and Repackaging Facility
WFM	Waste Facilities Management
WIPP	Waste Isolation Pilot Plant
WM	Waste Management
WMC	Waste Management Coordinators

Appendix A - Site Description

Los Alamos National Laboratory (the Laboratory) occupies 43 square miles of land in northern New Mexico and is located within the county of Los Alamos, ~35 miles northwest of Santa Fe. The Laboratory is divided into 50 technical areas (TAs), with locations and spacing that reflect historical development patterns, topography, and functional relationships. Owned by the Department of Energy (DOE), the Laboratory has been managed by the University of California (UC) since 1943.

Los Alamos is located in a temperate mountain climate at an elevation of ~7400 ft. In July, the warmest month of the year, the temperature ranges from an average daily high of 27.2°C (81°F) to an average daily low of 12.8°C (55°F). In January, the coldest month, the temperature ranges from an average daily high of 4.4°C (40°F) to a low of -8.3°C (17°F). The large range in daily temperatures results from the relatively dry, clear atmosphere, which allows strong solar heating during the day and rapid radiative cooling at night. The average annual precipitation (rainfall plus the water equivalent of frozen precipitation) is 18.7 in.

Topographically, the Laboratory is situated on a series of mesas separated by canyons. Most of the natural water and aqueous discharges from Laboratory operations flow into and along the canyon floors.